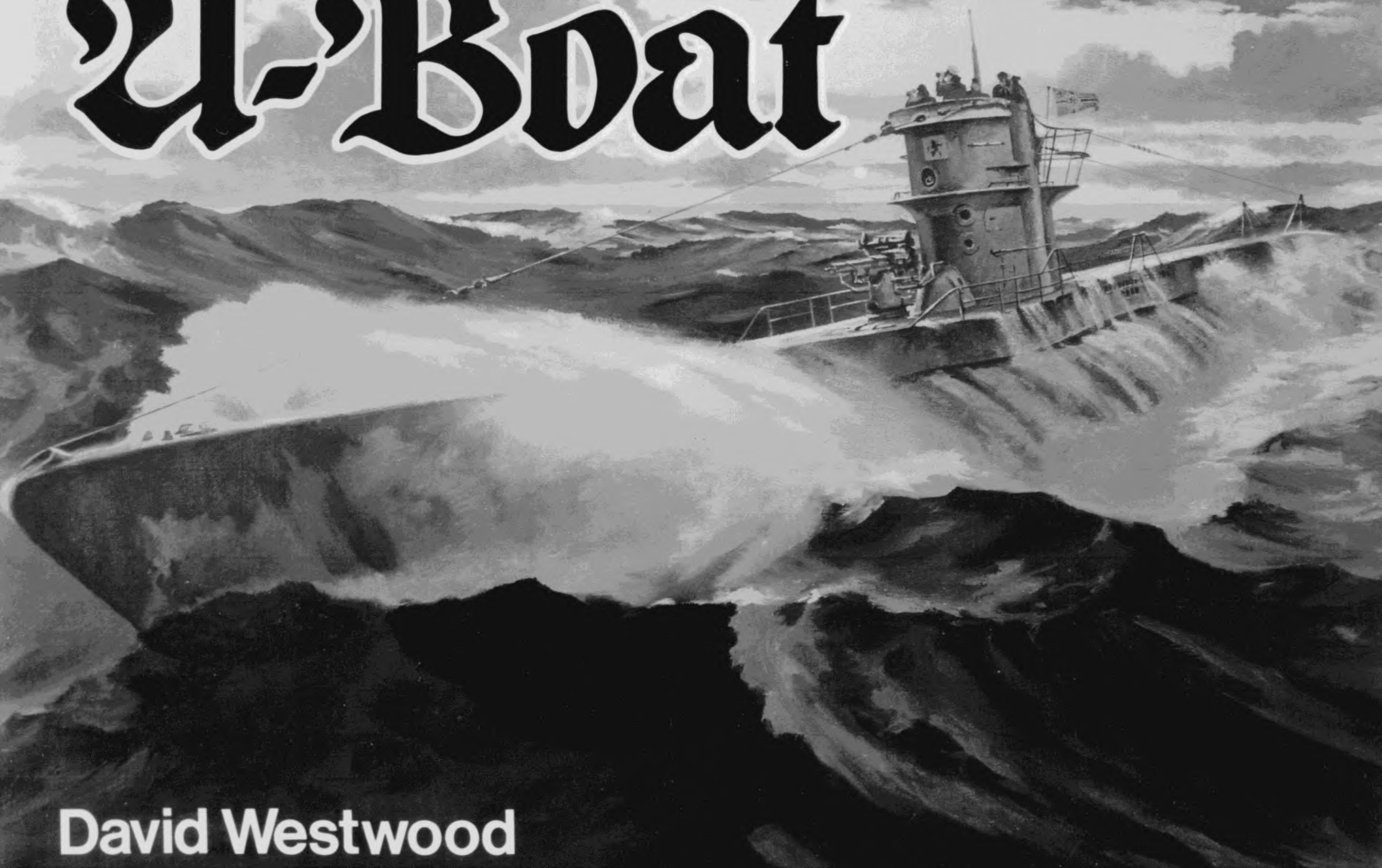


Anatomy
of the
Ship

The Type VII U-Boat



David Westwood

Anatomy of the Ship

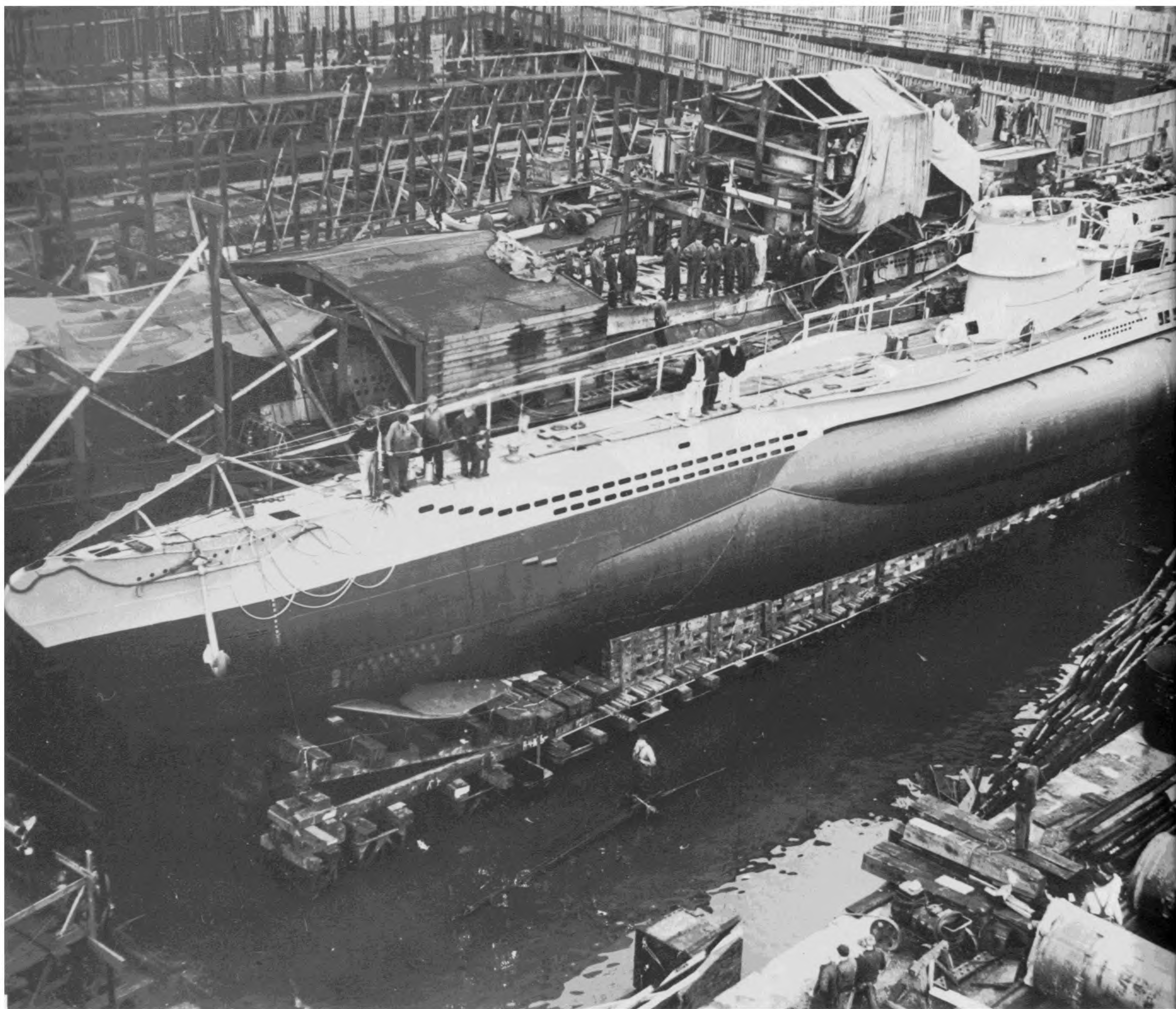
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David Westwood

CONWAY

MARITIME PRESS

Frontispiece. *U 99* on the day of her launch, 19 September 1940. Originally *U 69*, her number was changed in an attempt to convince Germany's enemies and the neutral countries that the submarine fleet was much larger than they thought. Here, the whole of the external section of the pressure hull can be seen, as well as the deck casing, and the fore and aft hydroplanes.

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FOREWORD

In a number of ways this volume departs from the pattern established for the 'Anatomy of the Ship' series by the first two volumes. The most obvious difference is the coverage, which relates not to a single ship but a whole class – and a class which was built in large numbers and in many variations. Furthermore, the submarine is a relatively small warship and has few of the external features which take up such a large part of earlier titles in this series. With these factors in mind, therefore, it was decided that *The Type VII U-boat* would concentrate on depicting the development of the design through its numerous stages. Ship modellers, who make up a significant proportion of the readership of the series, are unlikely to be so concerned with internal fittings as those visible externally, so the detail drawings are mainly confined to the latter.

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Introduction

At 21 minutes to eight in the evening of 3 September 1939, the SS *Athenia*, outward bound from Liverpool to Montreal with 1400 passengers, was struck by a torpedo. This was the first attack in the Second World War to be made by the German Navy, and the torpedo was fired by *U30*, a Type VII U-boat, commissioned in 1936. On 10 July 1945, the British steam fishing boat *Kned* was sunk by mine off Lizard Head, in a minefield laid in August 1944 by *U 218*, a VIID U-boat, commissioned in 1942. Thus the German naval war began and ended in submarine action.

Despite the operations carried out by the more glamorous surface ships, such as *Bismarck*, *Graf Spee*, *Scharnhorst* and *Tirpitz*, the major effort of this war was made by the Submarine Arm, which began hostilities with 57 boats, of which just 18 were Type VIIIs. At that time (September 1939) neither side had an inkling of what effect these boats would have as hostilities continued for five years and nine months, although Britain had instituted convoy sailing as early as August that year. Admiral Raeder, Commander-in-Chief of the German Navy, and Admiral Dönitz, Commander of the Submarine Arm, were agreed at the time that the German Navy could contribute little to the war apart from showing that its men knew 'how to die gallantly'.

The early stages of the war resulted in some singular successes for the U-boats: Prien and *U 47* entered Scapa Flow and (after a number of attempts) sank the *Royal Oak* at her moorings; Schuhart in *U 29* sank HMS *Courageous* at sea; von Tiesenhausen (*U 331*) sank HMS *Barham*. But throughout this period, and the much longer one that followed it, the main task of the U-boats was not in single handed derring-do, but the ceaseless grind of sinking merchant vessels, and most particularly merchant vessels in the North Atlantic that were supplying food, stores, weapons and ammunition from the vast manufacturing and supply warehouses of the Americas. If the U-boats could deny Britain the supplies that sailed across the Atlantic, Germany could count on the United Kingdom not only being removed from active participation in the war, but the island itself would be denied to America as a stepping-stone to Europe for the necessary invasion. The stakes were extremely high, and the German Navy soon invested all that it could afford in submarines, for the surface fleet never achieved the strength and balance planned by Raeder.

Once the French Atlantic ports had been captured, the U-boats increased their range and their rate of operation, for they no longer had to circumnavigate the British Isles (the Channel was denied them by

the Dover mine barrage); from the West Coast of France the Type VII boats could now reach out into the western part of the North and Central Atlantic, as well as operating in the Mediterranean and in the vicinity of the Azores and Gibraltar. For many months Dönitz suffered from a continual shortage of boats; this was due to Hitler's almost total lack of understanding of sea power, especially the importance of the North Atlantic, both strategically and economically. When Russia was invaded, the supply of steel and manpower became even shorter, and Dönitz waged a running battle with the Army for enough of both to build and crew the boats he needed to increase U-boat strength. He also campaigned – but in this instance lost – for a naval air arm. All he obtained were a few Focke-Wulf Fw 200 'Kondor' aircraft for aerial reconnaissance (many of which were almost continually grounded). Consequently he had no eyes constantly over the Atlantic watching for his targets – the convoys.

However he did evolve one tactic which optimised the performance of the Type VII. Underwater it had a low speed, but on the surface they could make 16-17 knots; Dönitz reasoned that if the U-boats were to have any chance of attacking the convoys successfully, they would have to go in on the surface, and at night. In daytime they could range the shipping lanes freely, looking for their targets, and report positions and courses to his headquarters so that he could order concentrations of boats for devastating attacks at night. This tactic proved extremely successful, the more so when the most experienced commanders – such as Prien, Kretschmer, Schepke, Schultze and others – actually began to go inside the convoys at night, firing their torpedoes from a mere two or three hundred metres. They reaped a terrible harvest.

By 1941 there was a distinct increase in the overall strength of the U-boat arm, and this was maintained, despite increasing losses, almost to the end of the war. The overall effectiveness of the arm began to fall however, from mid-1943. Allied countermeasures, initially woefully lacking, improved to such an extent that they eventually denied to the U-boats their one advantage – the ability to operate on the surface at night. By May 1943 the era of the Type VII was almost over: in the three months from March the Allies' combination of centimetric radar, seaborne direction-finding equipment, and very long range patrol and attack aircraft, coupled with increasing strengths and co-ordination of convoy escorts and successful anti-submarine tactics, forced Dönitz to withdraw the U-boats from the North Atlantic convoy routes, to seek safer targets elsewhere.

They enjoyed little peace in the more remote areas however, for a tactic that had proved unsuccessful initially – task forces hunting U-boats, rather than defending convoys – now reappeared with the advent of the escort carrier hunter group. Spearheaded by the US Navy, the hunter-killer groups soon had significant successes. This sudden reversal at sea forced the German Navy onto the defensive until such time as the new Type XXI boats (with a high underwater speed) were ready to go to sea. Happily for the Allies, the northern European land campaign was going so well that those boats never saw service in numbers. Had they done so, the war might have dragged on for a considerably longer time.

The Type VII was designed, above all, as a submersible torpedo-boat. It had none of the advantages of its nuclear descendants: able to stay underwater at speed for perhaps a few hours, and only any longer if unmoving, they were *forced* to the surface because they had insufficient (battery) power for long submerged operations. Thus battery-charging by running the diesel engines was mandatory. This was of no great import in the earlier part of the war, because air patrols were intermittent and very inexperienced. By May 1943 surfacing was fraught with danger, and standing orders from Admiral Godt (who took command of the Submarine Arm when Dönitz became C-in-C of the Navy) instructed captains to run on the surface with the boat in neutral buoyancy, with one diesel and one electric motor running, and to be ready to dive at all times.

The Schnorchel, adapted by the Germans from captured devices fitted to the Royal Dutch Navy 'O' type boats, now came into its own, together with a number of increasingly effective (but often too late, and always in short supply) electronic countermeasures. Indeed, it was in the period 1943 to 1945 that the foundations of present-day ECM were laid.

The Type VII may well have become out-dated, but it still found itself involved in all the theatres of naval warfare which it had the range to reach. In all, the Type VII was operating from Bear Island in the Arctic Ocean to the Bermudas and beyond, and from Greenland to Gibraltar, as well as into the Mediterranean. It was the largest class of submarines ever built (704 boats altogether), and certainly sank the lion's share of the total Allied and neutral shipping losses during the Second World War.

THE DEVELOPMENT OF THE TYPE VII

The history of German submarine involvement goes back to 1902, when a Spanish submarine designer, d'Equivelley, drew plans for the *Forelle*, an all-electric boat, which served as the forerunner for many hundreds of subsequent boats. The First World War showed what the submarine could do in economic warfare, and the decision in favour of the Allies was a fine one, dictated far more by events on land and in politics than at sea. One of the decisive factors on land was the injection of large numbers of fresh troops into France from America. Although not winning the battles, they boosted morale and stiffened the

otherwise depleted and almost exhausted defensive lines, and paved the way for decisive advances.

The war over, the submarine threat Germany had posed to Great Britain and France remained high in the consideration of the peace-makers: the Treaty of Versailles banned all manufacture of submarines in Germany, and eliminated her submarine fleet by confiscation. With her surface fleet almost emasculated, and her armaments firms forced back to making metaphorical plough-shares, the Germany Navy had recourse to one expedient only – subterfuge. In the 1920s covert companies were established to research armoured fighting vehicles, artillery, aircraft, surface ships and submarines, and many other aspects of the military art. None was more successful than the *Ingenieurskantoor voor Scheepsbouw* IvS), established in the Hague, which was entirely devoted to the study of the submarine. Design types of the late First World War period were scrutinised, and new designs and modifications put on paper.

The whole process would have been purely academic had not the strategic possibilities of the submarine, and its value as a coastal defender, been made abundantly clear by operations carried out during World War I. Nations with little need for battleships could see that the submarine could quite easily prove the cheaper countermeasure to the *Dreadnought* and its succeeding classes. Wilhelm Bauer, in the 1860s had designed two submarines, and he saw them rendering the enormous big-gun ships impotent. Seventy years later countries such as Finland, Turkey and Spain agreed with this view, although the Royal Navy was still suspicious of the submariner, seeing him not far removed from a pirate.

The countries mentioned, as well as Russia, Italy, Argentina, Estonia, Chile, Rumania, Japan, Yugoslavia, the Netherlands, China, Uruguay, Sweden, Portugal, Norway, Brazil and Bulgaria, all contacted IvS for design studies, and nine boats to these studies were actually built before Germany was allowed once more to possess a submarine arm in her navy. Boats were built for (and generally in) Turkey, Finland, Spain, Sweden, Russia and Rumania. Of these, the Spanish *E I*, the Swedish *Delfin* and the Rumanian *Marsuinul* all contributed to what was to become the German Type VII class.

In 1935 the London Naval Agreement was signed; the actual outcome of the conference was decided on the first day, when the German delegation announced that Germany wanted 35 per cent of the Royal Navy tonnage, and 45 per cent in submarines. If they did not get agreement on these figures, they had, they said, instructions to go home. The British Government and the Admiralty agreed, and further acquiesced in the near demand that Germany could increase her submarine strength to 100 per cent of that of the Royal Navy, should it be deemed desirable by the Germans, and after consultation with the Admiralty in Britain. Needless to say, there was no consultation, but the German submarine strength was almost equal to that of the Royal Navy in September 1939.

To return to *E I*, the plans were examined in detail by the German

Navy, and the design was put on a list of three types which were to be built, clandestinely if necessary, when the Armed Forces were able to re-equip. The arrival of Hitler as Chancellor, and soon Commander-in-Chief of the Armed Forces, meant immediate action in recruitment and rearmament for all three forces, although it was not until March 1935, that the Treaty of Versailles was unilaterally abrogated. Then came the London Naval Agreement, although the U-boats to form the 1st U-boat Flotilla, under the (then) Captain Dönitz, were already very close to being launched. Initially the Germans built the very simple, quick-to-complete, Type II boats; these were more for numbers than any thought of strategic value. The first Type VII boat (*U 27*) was laid down (order number 908 at A G Weser) on 11 November 1935, launched on 24 June 1936, and commissioned on 12 August 1936. This boat was the first of 704 boats of the class.

Building went on very slowly until the war was a year old. In the pre-war years Hitler kept assuring Raeder that war would not come until 1944, and so the C-in-C (Navy) planned to build a balanced fleet, with a number of aircraft carriers (possibly four in all), together with some of the most modern and powerful capital ships afloat; these were to be supported by adequate cruisers, destroyers and smaller craft, and a submarine arm of 221 U-boats by 1947. This would have been a formidable force, qualitatively an equal to any European fleet then in being.

War became inevitable far earlier than Hitler and his Grand Admiral believed. The Polish adventure turned into a European war, and the German Navy had very few submarines at all. Added to the paucity of numbers was the initial fear that America would enter the war at the slightest provocation. This led to restrictions being put on U-boat operations (and underscored heavily by the *Athenia* incident) so that the Type VII boats, and their larger sisters, the Type IXs, were unable at the outset to realise their full potential.

The basic *E 1* design was modified four times in 1928. The first design, of February, had six internal compartments, and was 47.95 metres long (pressure hull). The compartments were: bow torpedo compartment; accommodation compartment; control room; diesel engine compartment; electric motor compartment; stern torpedo compartment. In the next three designs this was extended to 7 compartments and 54.25 metres, by the addition of a second accommodation compartment, designed for the senior rates, aft of the control room. Ordinary seamen slept forward, among the torpedoes.

The boat was 755 tons surface displacement, 965 tons submerged. She was fitted with two 1400hp diesels and two 500 hp electric motors, giving her a maximum surface speed of 17 knots, and a maximum 8.5 knots underwater (this latter speed being of short duration). Carrying nearly 117 tons of fuel oil, she had a surface range of 11,200 nautical miles at 10 knots (her best cruising speed), and her batteries gave her a submerged range of 180 nautical miles at just 2.5 knots. This slow underwater speed was not considered problematic, because anti-submarine weapons and tactics were still in their infancy, and Asdic

was no more at that time than a fond wish of the steering committee.

So it was that the earlier UB type boats of the First World War were merely modified and uprated in power, and for this very reason their success was later to be severely limited. But the state of the art in 1930 was far removed from that of 1943. By 1933 a number of boat designs were being considered by the German Navy, some of which were adopted. The Type IA, of which only two were built, was a 500-ton design, which manifested appalling underwater performance characteristics; no more of this class were built. The Type II coastal boats have already been mentioned; it is sufficient to say that their range and torpedo capacity rendered them impractical for strategic warfare. The Type III was a hybrid, designed to carry two motor boats on the after casing in a watertight cylinder, but the design was not developed. The same fate befell Types IV (a supply and generating boat), and Types V and VI (both numbers being reserved for test boats with single propulsion units, capable of surface and submerged running). But the Type VII saw service in seven different forms, and two forms which did not come to fruition. Those that saw service were:

Type VII	10 boats built
VIIB	24 boats built
VIIC and C/41	660 boats built
VIID	6 boats built
VIIF	4 boats built
Totalling 704 boats built	

(This figure of 704 is of a grand total of 1152 submarines built during the period 1935 – 1945, disregarding the very small classes and Walter boats.) There were seven further designs under consideration (VIII, IX, X, XI, XII, XIII, XIV) of which three (IX, X, XIV) were built; all were much larger boats, designed to operate individually. Thus no less than 61 per cent of all German submarines constructed under Hitler's regime were of the Type VII class.

The designer of the Type VII, Schürer, based his work on the UB III class of World War I, modified in the light of the experience gained in building by IvS for the foreign customers mentioned above. The form of the boat was that of a cylindrical pressure hull, with bow and stern welded on to the fore and aft sections of the pressure hull. The addition of external casing was to give the boats some sea-keeping capability, which was denied to the simple cylinder of the pressure hull. They were all single-hulled boats, and the drawings show that the pressure hull emerges amidships. A casing deck was added, and the attack centre (frequently called the conning-tower in other countries) also had a casing, in this case designed to improve weather protection on the surface, and enhance underwater performance by reducing water resistance.

Internally the boats always had the following compartments:

Forward torpedo compartment and crew's quarters
Officers' and chief rates' accommodation

Control room with attack centre above
Senior rates' accommodation
Diesel engine room
Electric motor room

After torpedo compartment (although this was occasionally contiguous with the electric motor room).

Power then was provided by the diesels and the electric motors, and steering on the surface by engine manipulation and the rudder(s) aft. Diving, attitude and surfacing was controlled by a combination of the buoyancy of the boat (positive, neutral or negative), forward speed, and the angle of the two sets of hydroplanes.

External weapons comprised, at first, a main deck gun (8.8cm) and a single anti-aircraft (FlaK) cannon, usually of 2cm calibre. This, as will be seen from the Drawings, was altered considerably after the events of the spring of 1943, until a few U-boats were equipped as aircraft traps, an experiment which soon proved of no significant value. But the main armament of the submarine is the torpedo, and the torpedoes used were mainly Types G7a and G7e, with the issue later in the war of *Zaunkönig*, *LUT* and *FAT* type weapons.

The boats were designed with as much of their length forward of the engine room to increase their sea-keeping qualities, and this led to a short stern, in turn cutting the diving time considerably. The original tests of performance indicated that once saddle-tanks were fitted (to increase the boats' capacity to carry fuel oil, and with complementary ballast and diving tanks) performance was worse at surface speeds of 11-13 knots, but improved between 14 and 18 knots. As the range of

the boats was increased significantly by the addition of the saddle-tanks, they were retained. What was equally important was the fact that even with saddle-tanks, the boats could submerge in just 30 seconds, more than adequate until the end of the war.

It has already been mentioned that of the Type VII class, the large majority were of VIIC variant; in fact there were 572 VIIC boats built, and 88 VIIC/41 (the VIIC/41 was identical to the VIIC except that the steel used was a higher grade (Ww), and capable of withstanding greater water pressure: this meant an increased operating depth and great survivability in depth-charge attacks).

When Dönitz (now C-in-C, U-boats) looked at the boats available to him in 1936, he decided that the only boat that would continue to be built after initial orders (for Types IA, II, VII and IX) had been completed, would be the Type VII class. However, experiences with the Type VII (original form) required some modifications to be made, and these are shown in the details of the individual types below. (The Type IX also got a new lease of life as operations spread westward in the Atlantic.) In general terms, the class increased in displacement, range, torpedo-carrying capacity and offensive/defensive armament, as well as being increasingly more elaborately equipped with ECM sets of varying function and efficiency. But the basic form of the boats (even when drastically lengthened – see Types VIID and F, below, and in the Drawings Section), remained as in the original. The general opinion of the boats was favourable from the officers' and crews' point of view, and they proved their worth in the Battle of the Atlantic, for which they were mainly responsible.

Tables

TABLE 1: TYPE TYPE VII (ORIGINAL FORM)

Displacement:	Surface 626 tons, submerged 745 tons, (submerged, fully loaded and manned 915 tons)
Length overall:	Casing 64.51 metres, pressure hull 45.5 metres
Beam:	Casing 5.85 metres, pressure hull 4.7 metres
Keel to bridge overall:	9.5 metres
Draught (boat surfaced)	4.37 metres
Engines:	2 MAN 6-cylinder 4-stroke M6V 40/46 diesels totalling 2100-2310bhp Maximum revolutions 470-485rpm Maximum surface speed 16-17 knots Range 6200 sea miles at 10 knots; 2900 sea miles at 16 knots; Combined diesel/electric drive range 6800 sea miles at 10 knots Fuel oil 67 tons in all, of which 58.6 tons within the pressure hull
Motors:	2 BBC (Brown Boveri & Co) GG UB 720/8 electric motors totalling 750shp Maximum revolutions (geared down) 322 rpm Maximum submerged speed 8 knots Range underwater 73-94 sea miles at 4 knots Batteries <i>Us</i> 27, 31 - 33, 35, 36: 2 x 62-cell AFA type 27 MAK 740 producing 6940 amp hours. <i>Us</i> 28 - 30, 34: 2 x 62-cell AFA Type 33 MAL 740 producing 8480 amp hours
Builders:	<i>Us</i> 27 - 32 Deschimag, Bremen <i>Us</i> 33 - 36 Germaniawerft, Kiel
Built:	1935 - 1936
Designed:	The Type VII (sometimes, but erroneously, called the Type VIIA) was designed in 1933-34. Single-hulled submersible fitted with saddle-tanks (after they had been tested, as noted above). Six compartments, with internal trim tanks in Compartments I (aft torpedo room) and VI (forward torpedo room). Main diving tank and fuel oil tank under the control room. Regulating tanks (internal and external to pressure hull) pressure-tight, except for auxiliary tanks in the saddle-tanks. Additional diving tanks in bows and stern. Diving depth 100 metres, crush depth 200 metres. Diving times 50 seconds (normal); 30 seconds (neutral buoyancy)
Armament:	5-53.3cm (21in) torpedo tubes. Four in bow torpedo room and one external casing tube astern (non-reloadable). Bow tubes reloadable, and fitted below the constructed waterline. 11 torpedoes carried, or 22 TMA (torpedo calibre mines) or 33 TMB. 1-8.8cm C35 L/45 gun fitted forward of the tower; 1-2cm C30 aft of tower
Crew:	4 officers and 40 ratings
Boats:	1 dinghy, stowed under the forward casing, forward of the torpedo loading hatch

TABLE 2: THE TYPE VIIB

Displacement:	Surface 704 tons (dry), 753 tons (fuel and water tanks full); submerged 857 tons, fully loaded and crewed 1040 tons
Length overall:	Casing 66.5 metres, pressure hull 48.8 metres
Beam:	Casing 6.2 metres, pressure hull 4.7 metres
Keel to bridge overall:	9.5 metres
Draught (boat surfaced):	4.74 metres
Engines:	As Type VII but with superchargers (<i>Us</i> 45-50 2 Germaniawerft 6-cylinder 4-stroke F46 diesels with superchargers) totalling 2800-3200bhp Maximum revolutions 470 - 490rpm Maximum surface speed 17.2 - 17.9 knots Ranges 8700 sea miles at 10 knots; 3850 sea miles at 17.2 knots; combined diesel/electric drive range 9400 (from <i>U</i> 51 onwards 9700) sea miles at 10 knots Fuel oil maximum 108.3 tons; normal load 99.7 tons, of which 57.3 tons within the pressure hull
Motors:	2 AEG GU 460/8-276 electric motors totalling 750shp Maximum revolutions (geared down) 295rpm Maximum submerged speed 8 knots Range underwater 90 sea miles at 4 knots (reduced compared with Type VII due to greater displacement of VIIB) Batteries <i>Us</i> 45, 47, 51: 2 x 62-cell AFA 27 MAK 800 producing 7500 amp hours. <i>Us</i> 46, 48-50, 52, 53-55, 74-76, 83-85, 87, 99-102: 2 x 62-cell AFA 33 MAL 800 W producing 9160 amp hours. <i>Us</i> 73, 86: 2 x 62-cell AFA 33 MAL 800 E producing 9160 amp hours
Boats of the type:	<i>Us</i> 45-55, 73-76, 83-87, 99-102
Builders:	<i>Us</i> 45-55, 69-72 (The last four boats were renumbered <i>Us</i> 99-102 after war broke out as part of a deception scheme to mislead the Allies and neutrals as to the actual strength of the U-boat arm) Germaniawerft, Kiel <i>Us</i> 73-76 Vegesacker Werft, Vegesack <i>Us</i> 83-87 Flender-Werft, Lübeck
Built:	1936 - 1940
Design:	As for the VII but 2 metres longer overall to accommodate more internal stores and the S-Gerät listening apparatus, and to increase fuel tank capacity both internally and externally. The length-to-beam ratio (external) was now decreased to 10.7:1 compared with 11:1 of the VII, despite the increase in length; it was due to the much increased capacity of the saddle-tanks which now had a capacity of 42.4 tons of fuel oil, compared with the 8.4 tons of the VII. Diving depth 100 metres; designed crush depth 200 metres. Diving time 30 seconds (normal)
Armament:	As the VII except that the stern (single) torpedo tube was now placed within the casing, and was loadable from the aft torpedo compartment, where one reserve torpedo was carried. The length increase in the pressure hull allowed for this practical modification, and for the increased torpedo carrying capacity, which was 14 torpedoes in all, or 26 TMA or 39 TMB mines. Torpedo stowage was now: 4 in forward tubes; 8 slung in forward torpedo compartment; 1 in aft tube; 1 in reserve in aft torpedo compartment. Some boats were able to carry more in external containers below the casing forward and aft, but this was often discontinued because of problems in shipping these torpedoes inboard, and the further problems caused by diving and surfacing, affecting the pressurised depth-keeping apparatus in the torpedo. Note that <i>U</i> 83 was not fitted with a stern torpedo tube. Guns as for the VII (in both cases, gun changes were made to those boats that survived into the latter half of the war; for a guide, assume the details were as for the VIIC) 4 Officers, 44 ratings 1 Dinghy, fitted as for VII
Crew:	The first modifications to the original form showed promise, and the 24 boats of this Type saw much service. <i>U</i> 47 was Prien's, and penetrated Scapa Flow. <i>U</i> 48 survived the war until scuttled in May 1945, having sunk more shipping than any other U-boat. <i>Us</i> 99 and 100 (Captains Kretschmer and Schepke) were very successful indeed, only to fall prey to the Royal Navy within sight of each other in March 1941)
Boats:	
General:	

TABLE 3: THE TYPE VIIC

Note that the majority of the Drawing Section deals with this Type except where otherwise stated; they comprised 94 per cent of the class, and so it is with their details that much of this work is concerned. Nevertheless, where possible, despite exigencies of space, the other types receive some consideration.

Displacement:	Surface 719 tons (dry), 769 tons (water and fuel tanks full); submerged 871 tons (normal), 1070 tons (fully loaded)
Length overall:	Casing 66.5 metres, pressure hull 50.5 metres
Beam:	Casing 6.2 metres, pressure hull 4.7 metres
Keel to bridge overall:	9.6 metres
Draught (boat surfaced):	4.74 metres
Engines:	As Type VIIB (<i>Us 79-82, 90, 101, 102, 132-136</i> MAN, the remainder Germaniawerft diesels totalling 2800-3200bhp Maximum revolutions 470-490rpm Maximum surface speed 17-17.7 knots Range 8500 sea miles at 10 knots; 3250 sea miles at 17.2 knots; combined diesel/electric drive range 9700 sea miles at 10 knots Fuel oil maximum 113.5 tons; normal 105.3 tons, of which 62.1 tons within the pressure hull
Motors:	<i>Us 69-72, 89, 93-98, 201-212, 221-232, 235-300, 331-348, 351-374, 431-450, 731-750, 1051-1058, 1063, 1068, 1191-1214, 1271-1285, 1301-1312:</i> 2 AEG GU 460/8-276 electric motors. <i>Us 77-82, 88, 90-92, 99-100, 132-136, 401, 451, 452, 551-650, 751, 821-840, 929-936, 951-1050:</i> 2 BBC (Brown Boveri and Co) GG UB 720/8 electric motors. <i>Us 301-330, 375-400, 701-730, 752-782, 1131, 1132:</i> 2 GL (Garbe, Lahmeyer) RP 137/c electric motors. <i>Us 349, 350, 402-430, 453-458, 465-486, 651-698, 901-912, 921-928, 1101-1110, 1161-1170:</i> 2 SSW (Siemens-Schuckert-Werke) GU 343/38-8 electric motors. Output totalled 750shp in all cases. Maximum revolutions (geared down) 296rpm Maximum submerged speed 7.6 knots Range underwater 130 sea miles at 2 knots; 80 sea miles at 4 knots Batteries <i>Us 69-72, 77-80, 88-90, 93-95, 98, 99-102, 132, 133, 135, 136, 201-212, 221-226, 228-232, 238-240, 244, 245, 248, 251-255, 257-286, 291, 301-304, 306-313, 320, 328-345, 352-366, 372, 374, 376, 378-392, 401-404, 406, 408-412, 414-419, 421-425, 431-434, 436-440, 442-449, 451, 452, 454-458, 456, 466-472, 474, 551, 553, 556, 557, 559, 560, 562-571, 573-583, 585, 587-591, 594-599, 602-607, 609-617, 619-624, 626-638, 640, 642-668, 670-675, 682, 684-698, 701, 702, 710-713, 715-717, 720, 723-743, 751-757, 759-762, 764, 769-771, 777-782, 905, 907, 922, 951-957, 960, 963, 964, 967-994, 1053, 1104, 1131, 1133-1146, 1166, 1168, 1169, 1171, 1172, 1192, 1194, 1196-1199, 1201-1206, 1208, 1209, 1211-1214, 1272, 1306, 1331-1338, 1401-1404, 1417-1422, 1435-1439:</i> 2 x 62-cell AFA 33 MAL 800 W producing 9160 amp hours. All other Type VIIC: 2 x 62-cell AFA 33 MAL 800 E (9160 amp hours) except for a small number of boats having combinations of series E and W type batteries (the difference was the casing of the individual battery cells).
Builders:	(Type VIIC): <i>Us 69-72, 99-102, 93-98, 201-212, 221-232, 235-250, 1051-1058, 1063-1065</i> Germaniawerft, Kiel <i>Us 77-82, 132-136, 251-291</i> Vegesacker Werft, Vegesack <i>Us 88-92, 301-316, 903-904</i> Flender-Werft, Lübeck <i>Us 331-350, 1101-1106</i> Nordsee-Werke, Emden <i>Us 351-370</i> Flensburger Schiffbau Gesellschaft, Flensburg <i>Us 371-400, 651-686, 1131-1132</i> Howaldtswerke, Kiel <i>Us 401-430, 1161, 1162</i> Danziger Werft, Danzig <i>Us 431-450, 731-750, 825-828, 1191-1210</i> F Schichau, Danzig <i>Us 451-486</i> Deutsche Werke, Kiel <i>Us 551-650, 951-994, 1007-1110</i> Blohm und Voss, Hamburg <i>Us 701-722, 905-908</i> H C Stülcken Sohn, Hamburg <i>Us 751-782</i> Kaiserliche Marinewerft, Wilhelmshaven <i>Us 821-824</i> Stettiner Orderwerke, Stettin <i>Us 901-902,</i> (finishing work on <i>Us 903-908</i>) Stettiner Vulcan Werke, Stettin <i>Us 921-930</i> Neptun-Werft, Rostock Builders (Type VIIC/41): <i>Us 292-300, 1271-1279</i> Vegesacker Werft, Vegesack <i>Us 317-330</i> Flender-Werft, Lübeck <i>Us 687-698</i> Howaldtswerke, Hamburg <i>Us 723-730, 909-912</i> H C Stülcken, Hamburg

Built:	<i>Us 829-840</i> F Schichau, Danzig
Design:	<i>Us 931-936</i> Neptun-Werft, Rostock <i>Us 995-1006</i> Blohm und Voss, Hamburg <i>Us 1107 -1110</i> Nordsee-Werke, Emden <i>Us 1163-1170</i> Danziger Werft, Danzig <i>Us 1301-1308</i> Flensburger Schiffbau Gesellschaft, Flensburg 1938-1944 Once more there was an increase in fuel capacity by a slight increase in the overall size of the boat. Interestingly 5.6 per cent extra fuel capacity was achieved at a cost of only 1.6 per cent more displacement. Maximum speed remained about 17 knots, although the practical maximum was nearer 16 knots. The design for the boats was finalised in 1937-1938, and the only fundamental architectural change thereafter was the implementation of Ww grade steel in the VIIC/41 boats, listed above. The greatest variation came in armament and conning-towers (see below). The length-to-beam ratio was 10.7:1, as with the VIIB, for there was no increase in overall dimensions; the fuel increase came from enlarging the main midships fuel tanks. The following boats had 2 forward torpedo tubes only: <i>Us 72, 78, 80, 554, 555</i> The following boats had no stern torpedo tube: <i>Us 203, 331, 351, 401, 431, 651</i> The following boats had no mine-carrying capability: <i>Us 88-92, 333-350, 352-370, 374-401, 404-430, 435-450, 454-458, 657-686, 702-750, 754-782</i> and all boats Type C/41 from <i>U1271</i> upwards The 8.8cm was removed from many boats in 1942, and not included in requirements after that year. The threat of air attack was so great from 1943 onwards that additional and heavier calibre FlaK equipment began to appear on all boats. The bridge platform was increased in size by adding a lower platform to the one existing abaft the bridge itself, and the 'Wintergarten' concept of heavy anti-aircraft defence was brought into service. Gun types were generally the 2cm and 3.7cm FlaK cannon, in various combinations and permutations. There follow some of those variations: i: 1-2cm C30 on LC 30/37 mounting ii: 1-2cm C30 and 2 MG 151 machine guns (Mod I) iii: 2-2cm C30 on twin LC 30/37 (1 x 2) and 4 MG 151 machine guns (2 x 2) vi: 1-2cm C30 and 4 Breda machine guns (2 x 2; Mediterranean modification of <i>Us 81</i> and 453) v: Modification II - 2-2cm C38 (2 x 1), one on each level of the 'Wintergarten' vi: (Type VIID only, see below) vii: upper level 4-2cm C38 (2 x 2), lower level 4-2cm C38 and shield (1 x 4), or 1-3.7 cm automatic FlaK cannon viii: 1944-45 either 4-2cm C 38 M II on twin LM 42 U mounting (2 x 2) and 1-3.7cm M 42 U on LM 42 U mounting or instead of the 3.7cm weapon, 4-2cm FlaK 38/43 and shield (1 x 4), or 2-3.7cm M 42 on twin LM 42 U mounting (1 x 2) There are many more variations, some official, some put together by the boats' captains. The majority of the time however, the best chance of survival lay in a constant air watch, and readiness to dive in an instant. The FlaK defences had little success after a few initial surprises. A number of ECM sets were issued by the Germans to the U-boats, which met with varying degrees of success. A detailed discussion of them is not presented here, as they deserve a book in their own right. However some drawings show the various aerials, and the external appearance of the most common of the sets. 4 officers, 56 ratings 1. The various forms of the tower can be seen in elevation and plan in the Drawings Section. 2. Schnorchel. This was fitted as a standard equipment from mid-1944 onwards, with some boats having the equipment earlier. Essentially the Schnorchel was designed to get the boats into their operational areas as quickly as possible with the minimum danger. This meant that the diesels could be used to propel the boats, and the batteries were maintained at full charge, so that the boats could escape air or surface attack by going deeper. They could make good a fast escape, then return to Schnorchel depth and resume their course. With only the head of the raised inlet/exhaust arm showing above the water, the boats had
Armament:	
Crew:	
General:	

a better chance than on the surface. 3cm radar, developed in the United States, eventually limited even this method of maintaining the offensive.

3. The main additions to the VIIB that typify the VIIC are as follows:

- a. The tower was enlarged by 30cm in length and 6cm in width, giving slightly more room on the bridge, and improving the underwater contour of the tower
- b. Improvement of the diving characteristics by installing a pressure-tight diving tank (port and starboard) forward of the regulating tanks
- c. As noted above, increasing fuel tank li by 5.4 cubic metres
- d. Improvements in oil-cleaning equipment to increase engine performance
- e. Improvements in electric switching
- f. The provision of four canisters in the fore casing, each holding a 5 man inflatable life raft

Note: Drawings of the Type VIIC/42 boat have not been included as none were built. It was to have had a stronger hull (designed operational diving depth 280 metres; designed crush depth 400 metres), but only got as far as the design stage.

TABLE 4: THE TYPE VIID

Note that this boat was designed to fulfil a dual role, as both a minelayer and a torpedo-carrying boat

Displacement:	Surface (dry) 919 tons, normal 965 tons; submerged 1080 – 1285 tons depending upon armament carried
Length overall:	Casing 76.9 metres, pressure hull 59.8 metres
Beam:	Casing 6.38 metres, pressure hull 4.7 metres
Keel to bridge overall:	9.7 metres
Draught (boat surfaced):	5.01 metres
Engines:	2 Germaniawerft 6-cylinder 4-stroke F 46 diesels with superchargers totalling 2800-3200bhp Maximum revolutions 470-490rpm Maximum speed 16-16.7 knots Range 11,200 sea miles at 10 knots; 5050 sea miles at 16 knots; combined diesel/electric drive range 13,000 sea miles at 10 knots Fuel oil maximum 169.4 tons; normal 155.2 tons, of which 115.3 tons within the pressure hull
Motors:	2 AEG GU 460/8-276 electric motors totalling 750shp Maximum revolutions (geared down) 285rpm Maximum submerged speed 7.3 knots Range underwater 127 sea miles at 2 knots; 69 sea miles at 4 knots Batteries: 2 x 62-cell AFA 33 MAL 800 E cells producing 9160 amp hours (U 217 W type cells)
Builder:	Us 213-218 Germaniawerft, Kiel.
Built:	1940-1942
Designed:	The design was completed in 1939-40 to fill the need for more minelaying craft which could be easily built. The Type IX and X boats soon took over this role however, and only these 6 boats were built. They were identical to the standard Type VIIC with the exception that between frames 39 and 40 (aft of the tower) a 9.8-metre insert was built in. This contained five vertical unpressurised mine shafts, each holding three SMA mines. The extension of the main hull meant that the saddle-tanks could also be extended, and this led to the increased fuel capacity. Extra ballast and diving tanks could also be incorporated. Diving depth 100 metres; designed crush depth 200 metres. The twin rudders and the hydroplanes were as fitted to the VIIC. A Schnorchel was carried on the port side of the tower.
Armament:	5-53.3cm (4 forward and 1 stern) torpedo tubes; 12 torpedoes or 26 TMA or 39 TMB mines could be carried, as well as 15 SMA mines in the midships mine shafts 1 – 8.8cm C35 L/45 main deck gun with 220 rounds of ammunition 2 – 2cm FlaK cannon C30 (2 x 1) with 4380 rounds of ammunition After 1942 defensive armament changed to: 1 – 3.7 FlaK with 1195 rounds of ammunition 4 – 2cm C38 (2 x 2) with 4380 rounds of ammunition

Crew:	4 Officers and 40 ratings
Boats:	1 dinghy
General:	The normal FlaK balcony aft of the bridge was widened rather than lengthened in the VIID so that it did not overhang the forward mine shaft. The boat was a stop-gap, and nothing more; only one survived the war, to be sunk in Operation 'Deadlight' (the post-war Royal Navy operation that scuttled the surrendered U-boats not required for evaluation and experiments)
Note:	Little is known of the Type VIIE design, except that it was for a boat with an uprated engine. It got no further than design sketches.

TABLE 5: THE TYPE VIIF

Displacement:	Surface 1084 tons; submerged (dry) 1181 tons, (fully loaded and manned) 1345 tons
Length overall:	Casing 77.63 metres, pressure hull 60.4 metres
Beam:	Casing 7.3 metres, pressure hull 4.7 metres
Keel to bridge overall:	9.6 metres
Draught (boat surfaced):	4.7 metres
Engines:	2 Germaniawerft 6-cylinder 4-stroke F 46 diesel totalling 2880-3200bhp at 470-490rpm Maximum surface speed 16.9-17.6 knots Range 14,700 sea miles at 10 knots; 5350 sea miles at 16.9 knots; combined diesel/electric drive range 13,950 sea miles at 10 knots Fuel oil 198.8 tons
Motors:	2 AEG GU 460/8-276 electric motors totalling 750shp Maximum revolutions (geared down) 295rpm Maximum submerged speed 7.9 knots Range underwater 130 sea miles at 2 knots; 75 sea miles at 4 knots Batteries 2 x 62-cell AFA 33 MAL 800 E (U 1059 W type) producing 9160 amp hours
Builder:	Us 1059-1062 Germaniawerft, Kiel.
Built:	1941-1943
Designed:	The design, based on the VIIC, was completed in 1941; they were conceived as both fighting boats and supply vessels. The torpedo compartment added (in a similar manner to the VIID) was for either the boat's own use, or for re-supplying boats in operational areas which had adequate fuel, but were short of torpedoes. By the time they came into service (March 1943), the day of the U-boat was past, and they served solely as fighting boats. They had a Schnorchel on the port side of the tower, the VIIC's rudder arrangement, and diving time was about 35 seconds. Only U 1061 survived, being sunk in Operation 'Deadlight'.
Armament:	5-53.3cm (4 forward, 1 stern) torpedo tubes. The normal inboard 14 torpedoes were carried to fight the ship. No mine capability. Up to 21 torpedoes could be carried in the torpedo cargo room; 2 further torpedoes could be stowed in watertight containers either side and aft of the tower 1 – 3.7cm with 1195 rounds of ammunition 2 – 2cm C38 with 4380 rounds of ammunition
Crew:	4 officers, 42 ratings
Boats:	1 dinghy
General:	As with the VIID this hybrid design suffered from other more suitable designs taking its place, and from the general situation in the battle areas. It was a stop-gap design that had no valid role by the time it was completed.

TABLE 6: GERMAN SUBMARINE TORPEDOES

Type		Propulsion	Range/speed	Notes
G7a	T1	Compressed air (wet heater)	6000m/44kts 800m/40kts 14,000m/30kts	The pre-war issue torpedo, it had the disadvantage of leaving a visible trail of bubbles on its way to the target.
G7e	T2	Electric	5000m/30kts	The standard torpedo of the war. It suffered from early problems with its internal depth-keeping equipment, and its firing pistol, but these were solved after a Board of Enquiry following the Norwegian Campaign.
	T3	Electric	5000m/30kts	As for the T2 but fitted with an influence fuse
	T4	Electric	7500m/20kts	The first homing torpedo, fitted with a passive acoustic homing device, but very few were used.
	T5	Electric	5700m/24kts	The 'Zaunkönig' ('Gnat'). Intended to be an escort killer, it achieved some minor early success only to be countered by the 'Foxyer' noise-making decoy.
	T11	Electric	5700m/24kts	A modified T5, less affected by 'Foxyer'. Never used in battle conditions, although late test results were promising.

Notes: All the above were 53.3cm (21-inch) torpedoes. There were also two important pattern-running devices which could be applied to various torpedo types. These were 'FAT' and 'LUT'. 'FAT' ran a wandering course with regular 180° turns, was useful against convoys, and was fitted to both G7a and to G7e T3s. 'LUT' was more sophisticated with more variable patterns, but was only used operationally towards the end of the war.

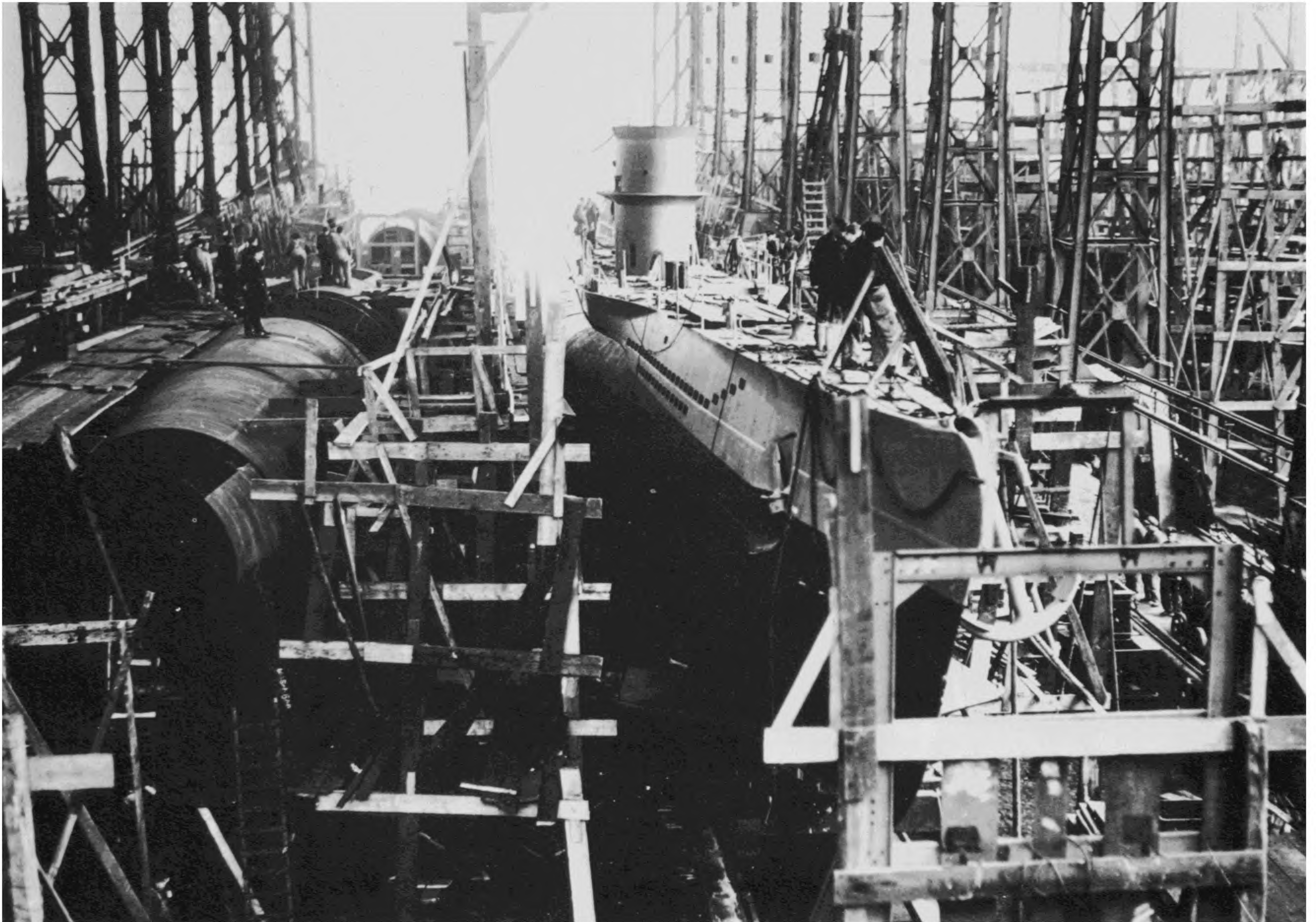
TABLE 7: U-BOAT GUNS AND MOUNTINGS

Type	Notes
7.92mm MG C34	The naval version of the standard German infantry machine gun. The rate of fire was c1000rpm, but the weapon was ineffective against aircraft.
2cm MG C30	The first of a number of 20mm weapons fitted to the U-boats. it was normally mounted as a single weapon, and could be operated by two men. Rate of fire was 280–300rpm. Watertight canister mount, or free-swinging single or twin LC 30/27 mountings.
2cm FlaK 38	This was an enhanced version of the MG C30, with an increased rate of fire (450-500rpm). It was mounted initially as for the C30, but there were also more advanced LM 43 U (<i>Flak-Zwillling</i>) twin mounts and the quadruple L 38/43 U (<i>Flak-Vierling</i>).
3.7cm SKC30U	The first larger calibre FlaK issued to the U-boats. This version was manually loaded, and had a rate of fire of approximately 30rpm. Later versions were automated. Fitted on a single LC 39 mounting.
3.7cm FlaK M42U	An automatic gun, based on the army's Flak 36, capable of 160–180rpm. It was mounted late in the war on LM42 U single and twin mountings.
8.8cm SKC35	The naval version of the army 'eighty-eight', but ammunition was not interchangeable. This 45-cal gun was intended for use as auxiliary armament, and often used to sink small craft, or administer the <i>coup de grâce</i> to vessels not worth another torpedo. Fitted on hand-worked single LC 35 mountings.

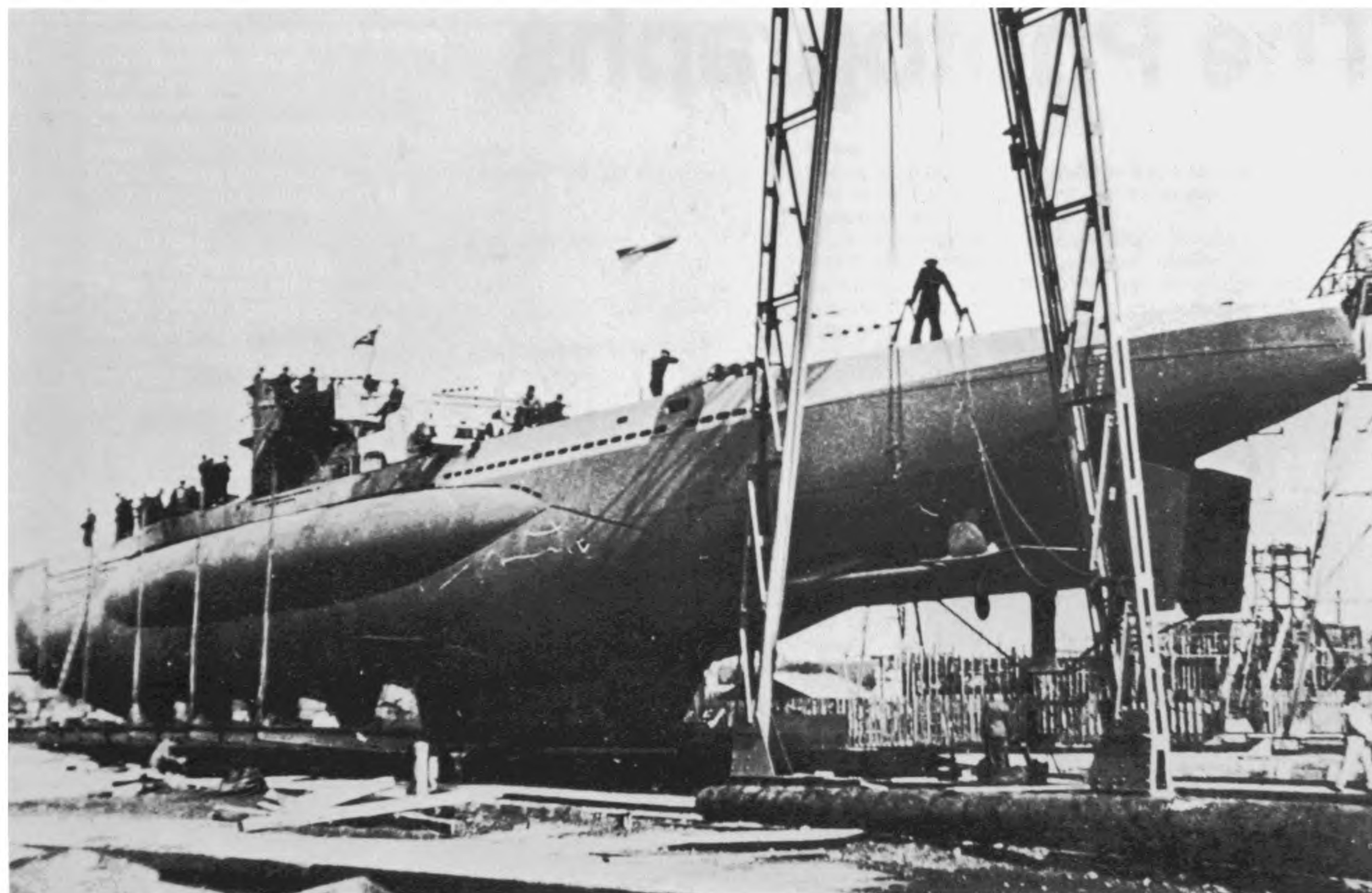
Note: German gun designations can be confusing. 'SKC' denotes 'ship gun', followed by two numbers denoting the normal year of development (ie omitting the 19-). This is often shortened to just 'C' and the year. A 'U' (for 'U-boat') was added to designate a submarine gun or mounting, and 'FlaK' was sometimes included with AA guns. From early in the war the prefix became 'KM', or 'FlaKM' and the date. Mountings were prefixed by 'LC', and later 'LM', or simply 'L', followed by the date (as for guns). In common usage, almost all these designations were regularly shortened.

The Photographs

1. *U 98* shortly before she was launched. A Type VIIC boat, the lines of her bow and the forward outer casing can be seen clearly. She took eleven months to build. The tower is of the standard type, with which the Type VII boats were generally fitted until 1943. On the left, at an early stage of building, is the pressure hull of *U 208*. Both boats were built by Germaniawerft at Kiel, on Slip 4.



2. This stern view of a Type VIIC boat shows the fineness of the lines aft of the conning tower. The twin rudders are most noticeable. Her number is not known, but it is clear that she has been commissioned, because the *Reichskriegsflagge* is flying at the ensign staff. She has probably been into dry dock for modification or repair.



2

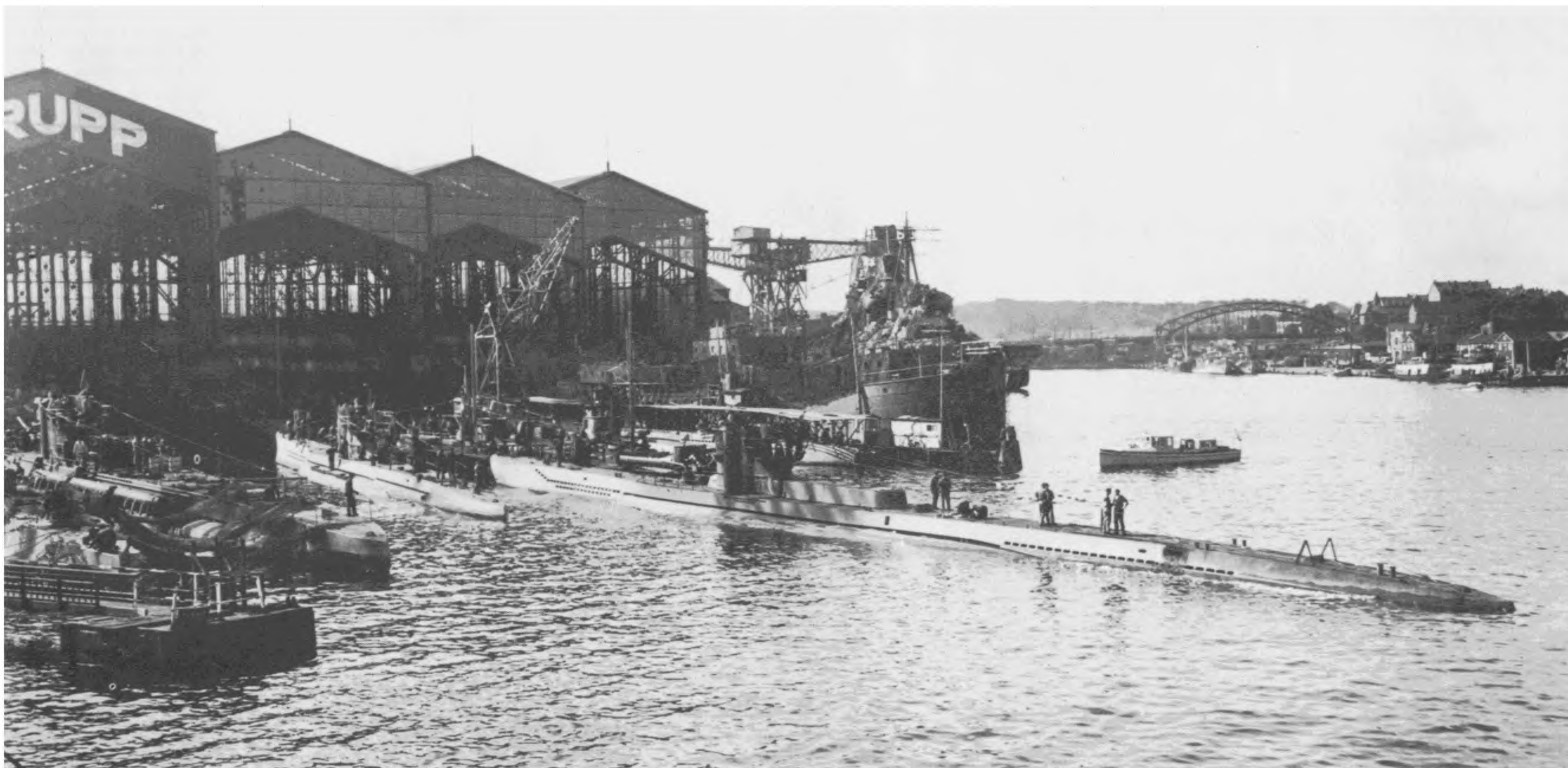
3. This photograph also depicts a Type VIIC boat, lying at anchor after launch. She flies no flag, and has no armament fitted so must be awaiting a move to a finishing dock. The port saddle-tank, and (below, forward) the pressure hull can be seen, as well as the characteristic drainage slots of this type.



3



4. The Type VIIC U 570 was the first U-boat to be captured intact, when she surrendered to two Hudson aircraft of Coastal Command on 4 October 1941. Seen here in a British port under the White Ensign, she was later commissioned for evaluation as HMS *Graph*.
Conway Picture Library.

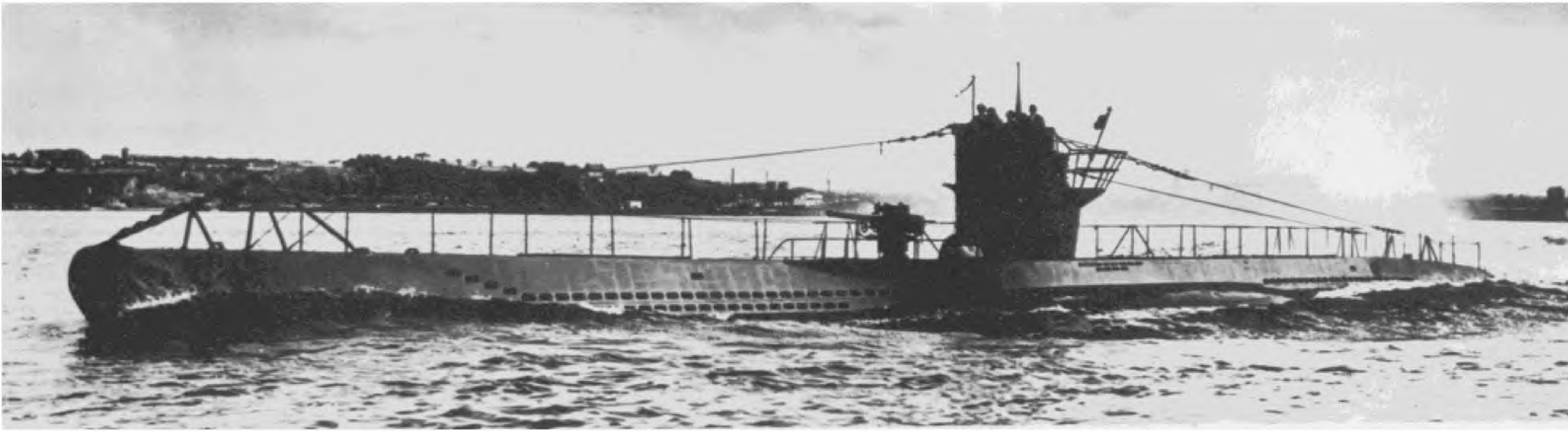


5. *U 218*, a Type VIID, after she was launched at Krupp's Germaniawerft in Kiel, on 5 December 1941. She has completed her training period with the 5th U-boat Flotilla, and is back in Kiel for fitting out before joining her operational flotilla (the 9th) in Brest, which she did in September 1942. She survived the war, and at the end of hostilities was in Bergen. She sailed from there and was scuttled by the Royal Navy in Operation 'Deadlight'. The photograph also shows *U 226* and *U 227* (both Type VIIC) and enables some comparison of the respective sizes of boats to be made.

6. A Type VIIC boat at sea in the Baltic. Casing hatches fore and aft of the tower are open, the harbour rails are fitted, and two crew members are seen on the aft FlaK platform - the only place for a cigarette. The boat was probably based in the Baltic and used for training purposes.



7



7. Another of the trick-numbered U-boats, *U 100*, which was originally *U 70*. This near-silhouette, taken late in the afternoon, shows the forward casing draining slots and the bridge outline.

8



8. This camouflaged boat is *U 617*. Launched and commissioned in 1942, she had the doubtful honour of being transferred into the Mediterranean as a result of the Allied landings in North Africa. The camouflage pattern did her no great service, and she was lost on 12 September 1943. First attacked by aircraft of 179 Squadron RAF, she was beached by orders of her Captain, KL Brandt. Then she was destroyed where she lay by the combined gunfire of HM Ships *Hyacinth* and *Haarlem* and HMAS *Wollongong*.

9



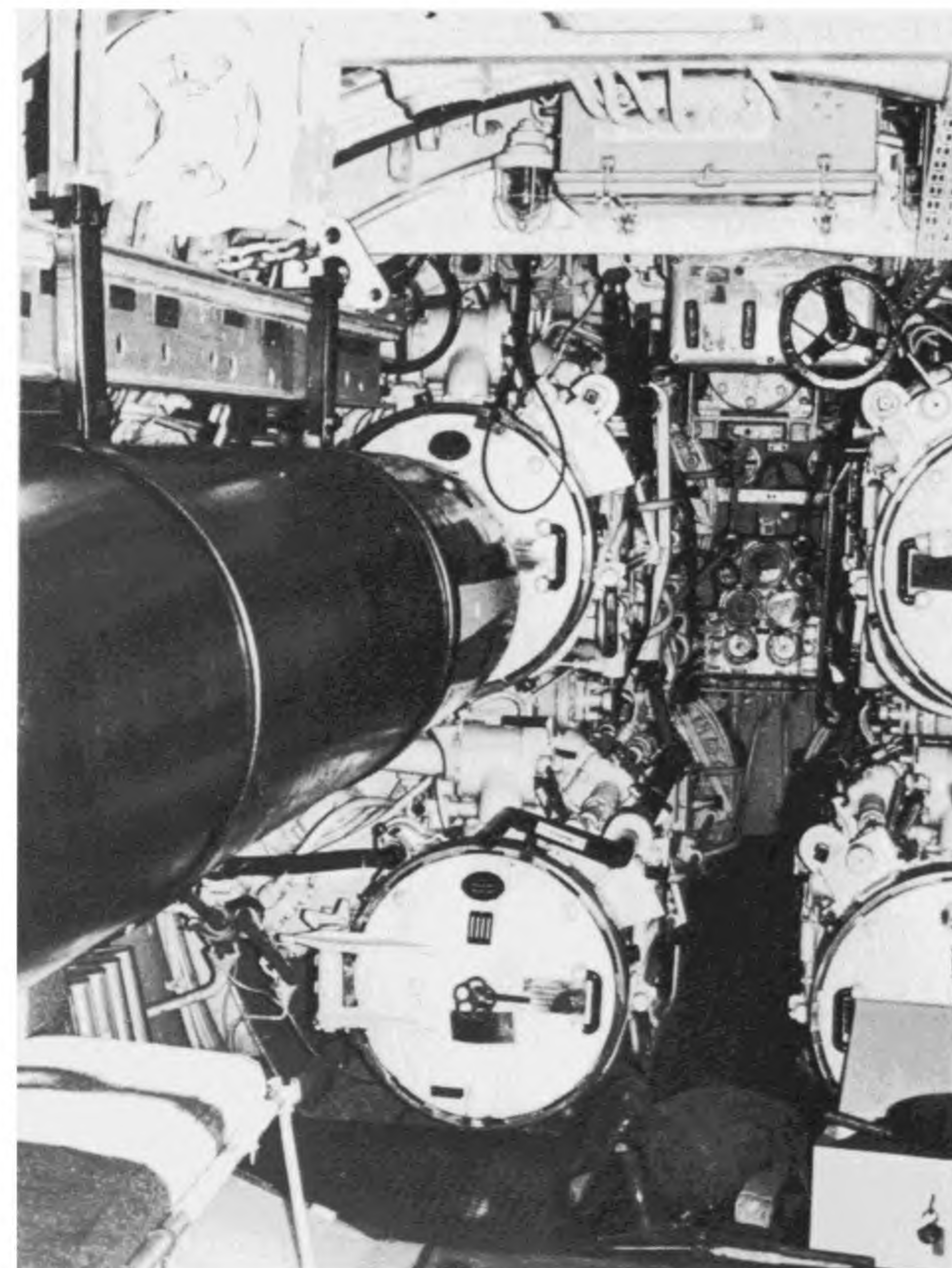
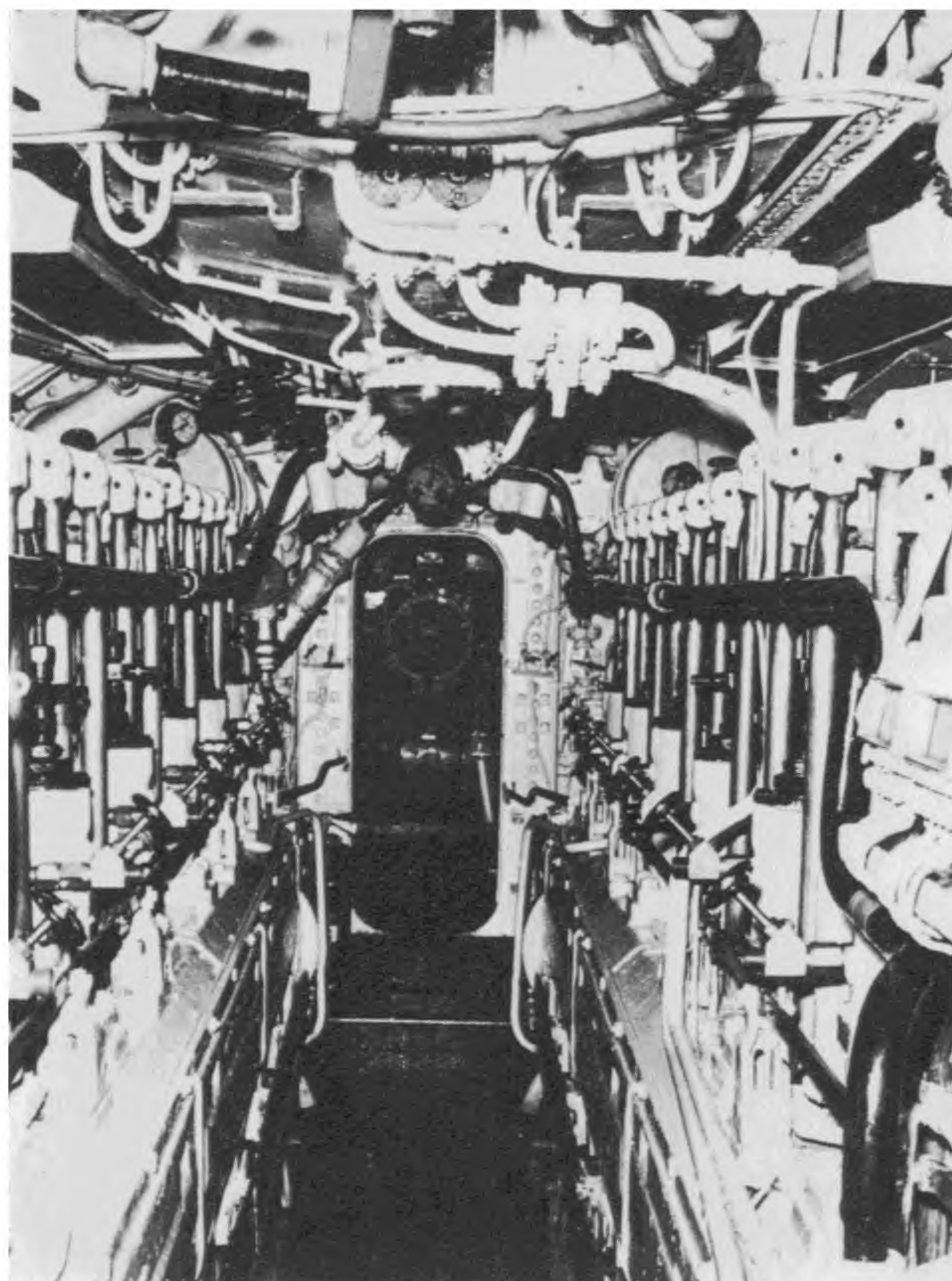
9. Although the boat in the photograph is a Type II (*U 14*), the torpedo is a standard G7a weapon, which was the basic torpedo of the *Kriegsmarine*, until the G7e was issued, the latter being propelled by electric motors as opposed to compressed air.



10. This is a breech view of the standard main deck gun, the 8.8cm C35 L/45. The 8.8cm saw service elsewhere, notably as an anti-aircraft and anti-tank gun, and in the German Navy was used by the U-boats for attacks on small vessels, and to administer the *coup de grâce* to larger targets. Such use of deck guns was possible in the first half of the war, and saved many torpedoes; later they were all removed due to the dangers of surface operation. This gun had no anti-aircraft facility, being designed solely for surface-to-surface gunnery.

11. The Captain and First Lieutenant at the periscope. (The Captain may be K Kapt Georg Lassen, who survived the war.) The periscope viewing base is quite clear, as is the angle setter (marked -10 to +20 degrees). To the left of the picture is the eyepiece for reading the bearing angle to target. This is the control room periscope, which eventually became the air-search periscope.

12. The diesel engine compartment. On either side of the photograph stand the 6-cylinder diesel engines, and the vertical rods are the engine valve operating arms. At the top of the picture, which shows the view aft, is the control wheel for the engine room air intake trunking (closed when diving). In the centre of the photograph is the watertight door to the Motor Room, and two revolution counters can be seen as well as the central fuel indicator gauge. On the upper part of the picture are two fume extractors, either side of the fuel gravity tank.

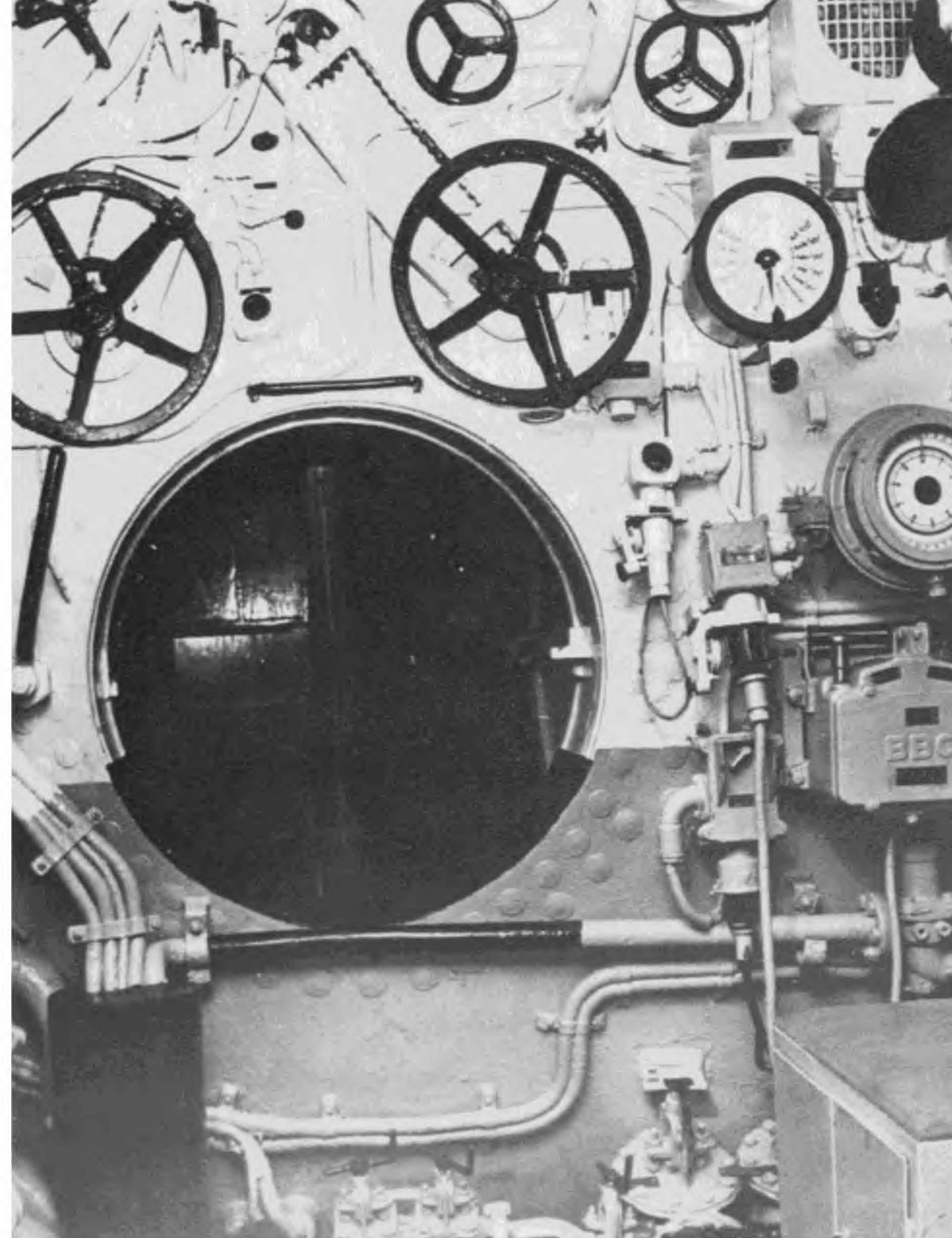


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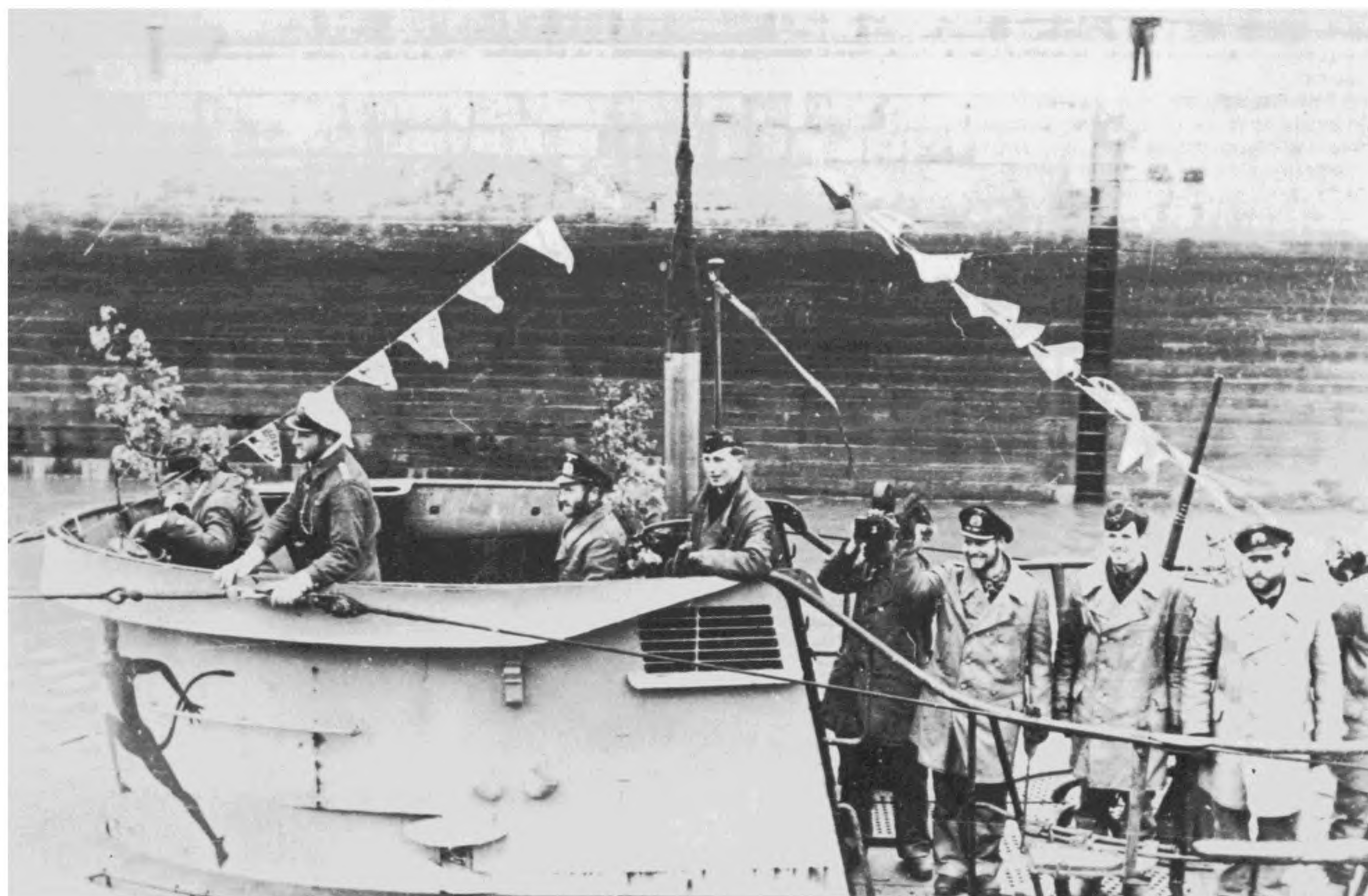


13. This photograph shows the forward torpedo compartment. The four inner tube doors can be seen, with a G7e torpedo slung in the loading position for Tube II. On the forward bulkhead is the main firing control panel, which is of interest because it is the 'LUT' (see Table 6) firing board. The air pipe from the torpedo compressed air cartridge to Tube IV is clearly visible as well as the (black painted) flooding tube, which led from the Tube via the control valve to the torpedo flooding tank.

14. This view shows the forward watertight bulkhead opening (leading forward to the officers' quarters).

15. *U 552* returning to base after a successful patrol. KL Topp is seen on the port side of the bridge, with his First Lieutenant by the attack periscope housing. The watchman on the fore bridge is calling engine orders to the control room via the voice pipe. The small flags record the sinkings during each patrol the boat made, and *U 552* and Topp were together from December 1940 until August 1942. The running devil motif on the bridge casing was one of many that appeared early in the war, but were largely dispensed with later on when the Allied successes against the U-boats removed any light-heartedness there had been among the crews.

16. The commissioning of *U 201* on 25 January 1941. KL Schnee, the Captain is looking aft on the port side of the bridge. He was just 27 at the time, and had already commanded *Us 6* and *60*. The boat's shield is seen above the wave deflector. *U 201*, unlike Captain Schnee, did not survive the war, being lost (under another commander) in February 1943 to depth charges from HMS *Fame* off Newfoundland.



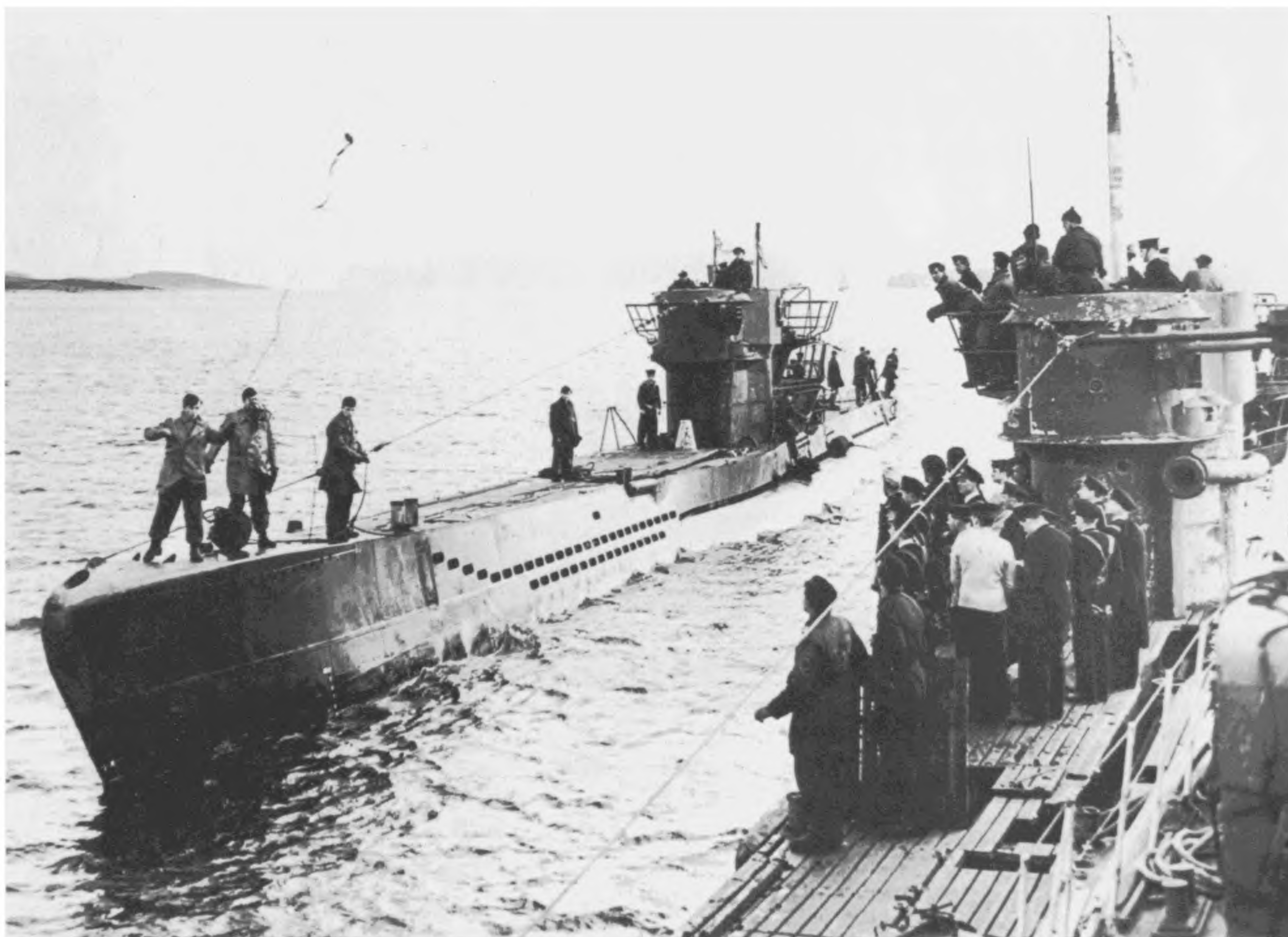
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17. A meeting between *U 826* and *U 236* (both Type VIICs) after the end of the war. All armament has been removed, they both fly the White Ensign, and the hats of many of the crew of the righthand boat are certainly Royal Navy issue. The crew members on the forward casing of the docking boat are German Navy, no doubt impressed to sail the boat to Loch Ryan for Operation 'Deadlight'. The Schnorchel inlet on the port side of the tower casing is most visible in the righthand boat, while the other boat shows off her 'Wintergarten' railing very well.

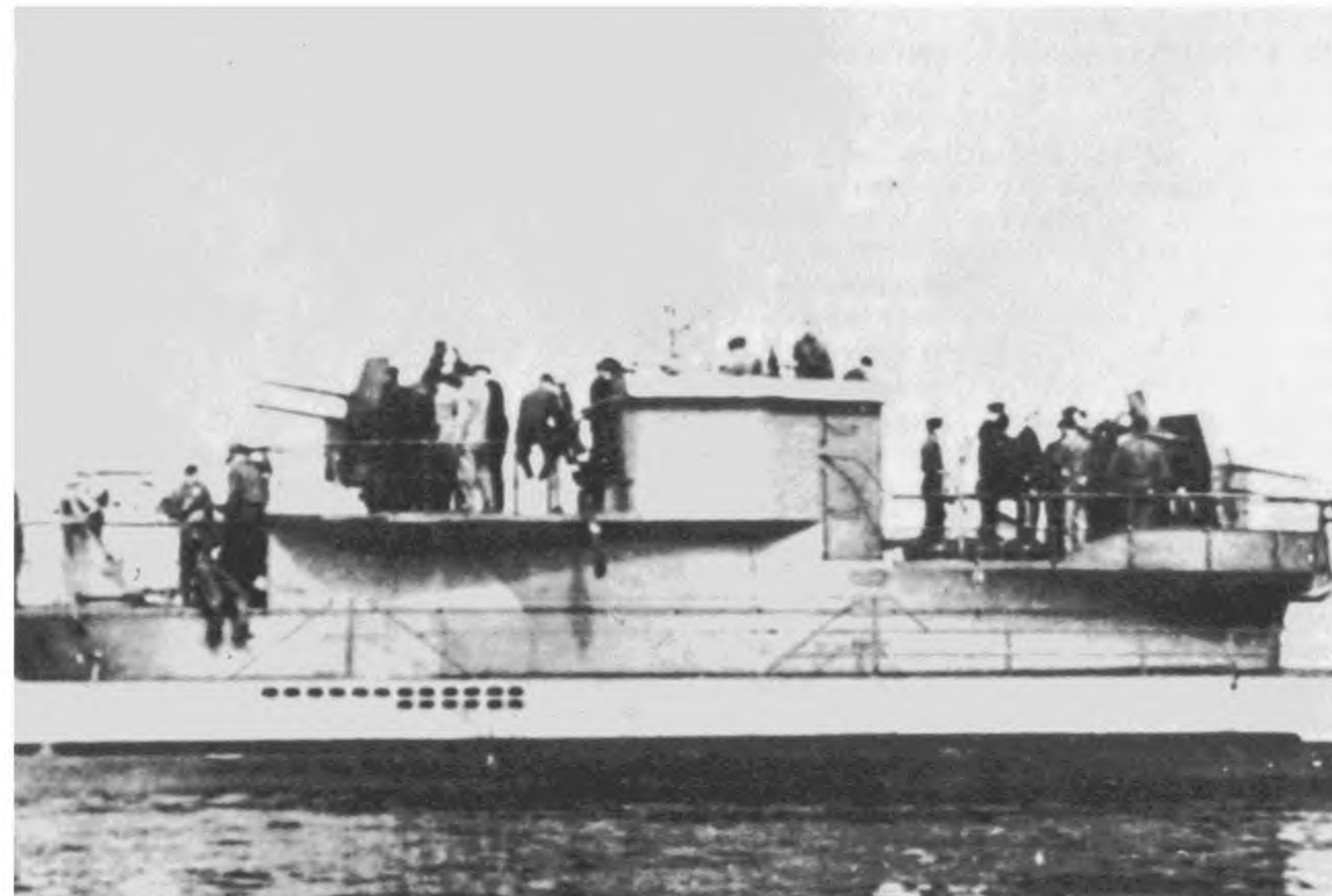
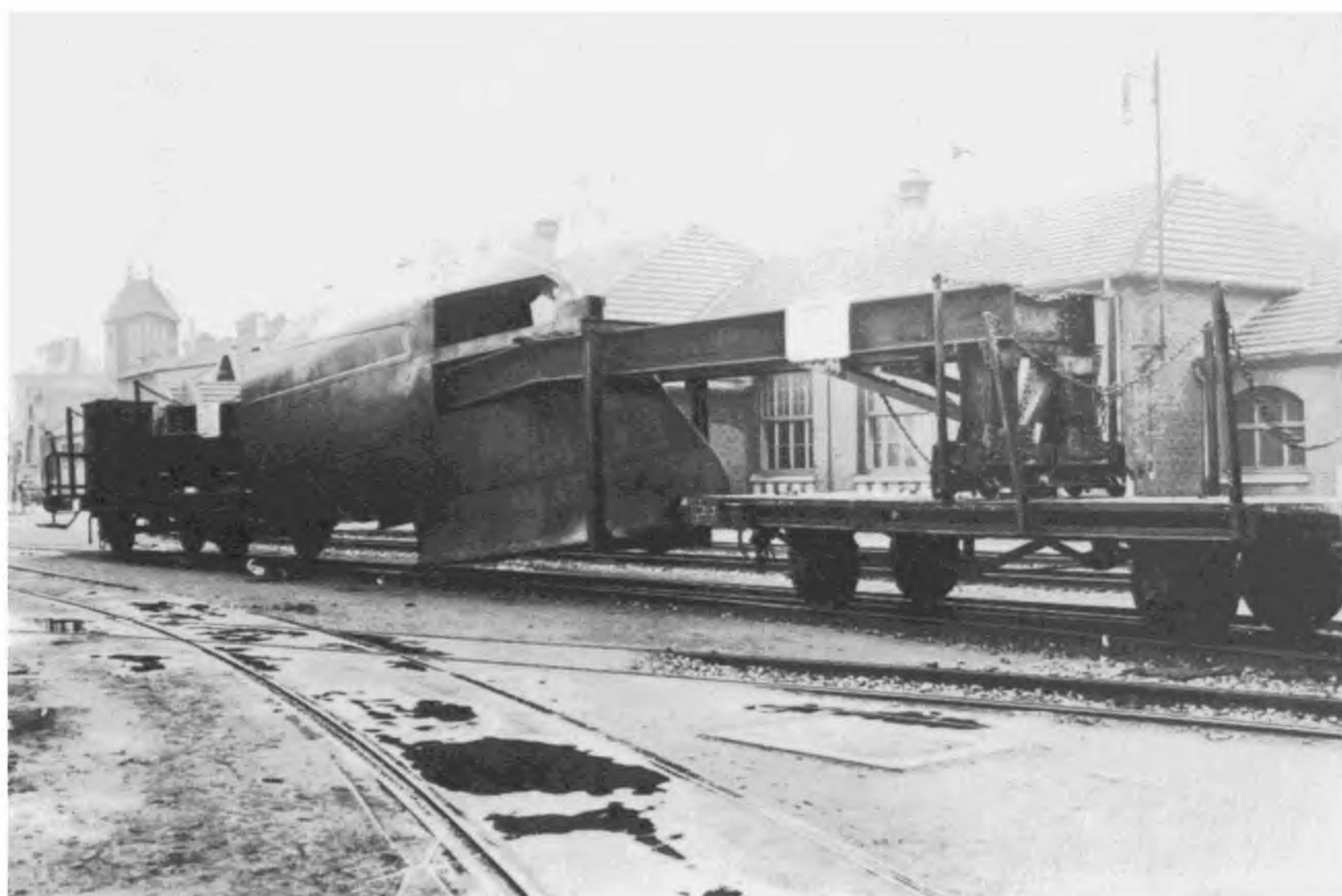
18. A bow outer casing section en route to the final assembly yard. With the advent of the so-called strategic bombing offensive the German Navy decided wherever possible to prefabricate both outer casing sections and pressure hull segments. This was also aimed at cutting the amount of time the boats were lying on the stocks, vulnerable to bombing (which was rarely that effective).

19. Starboard view of *U 441 (U FlaK 1)*. The quadruple 2cm mountings were visible fore and aft of the bridge, as well as the aerial for the FuMO 61.

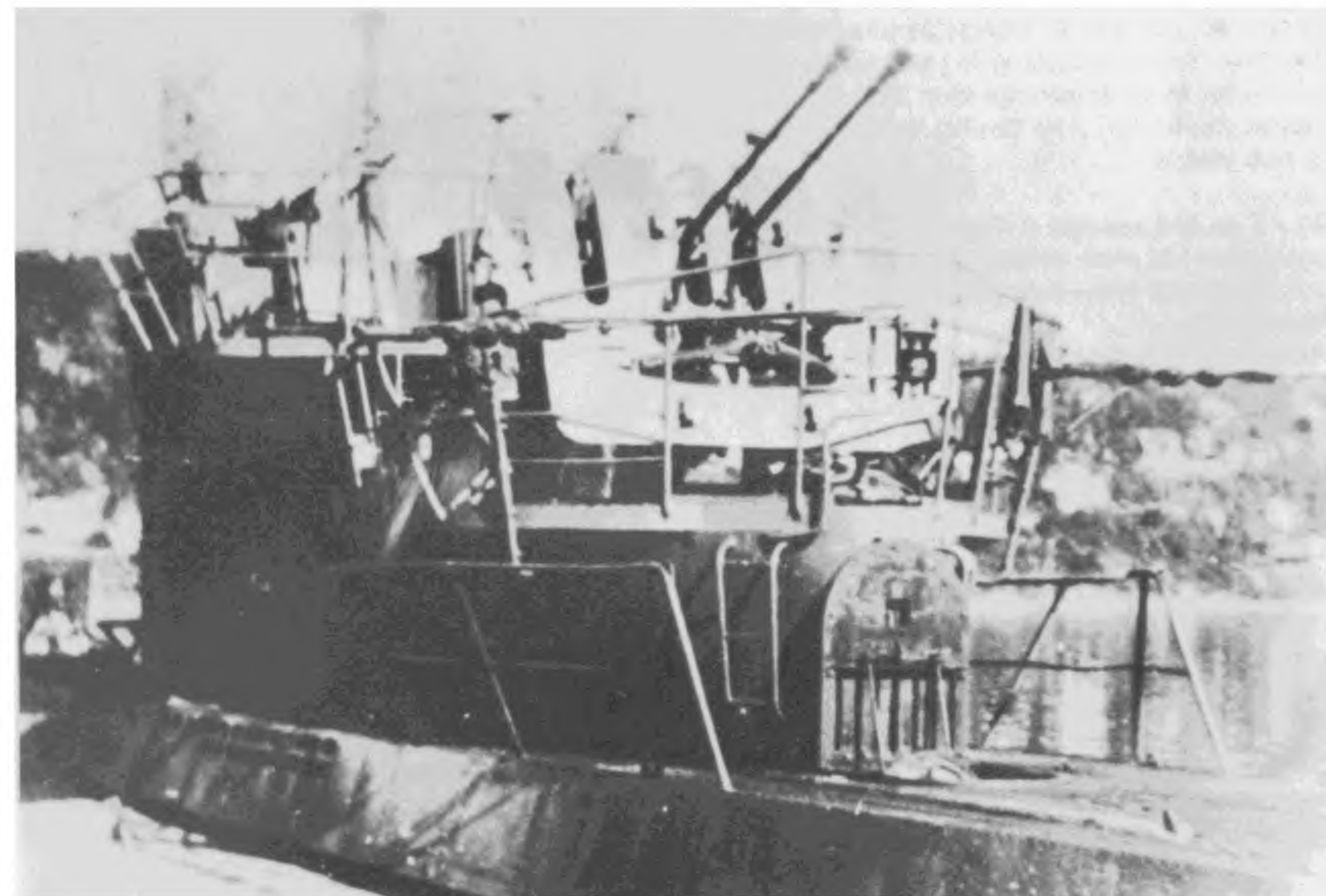


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19



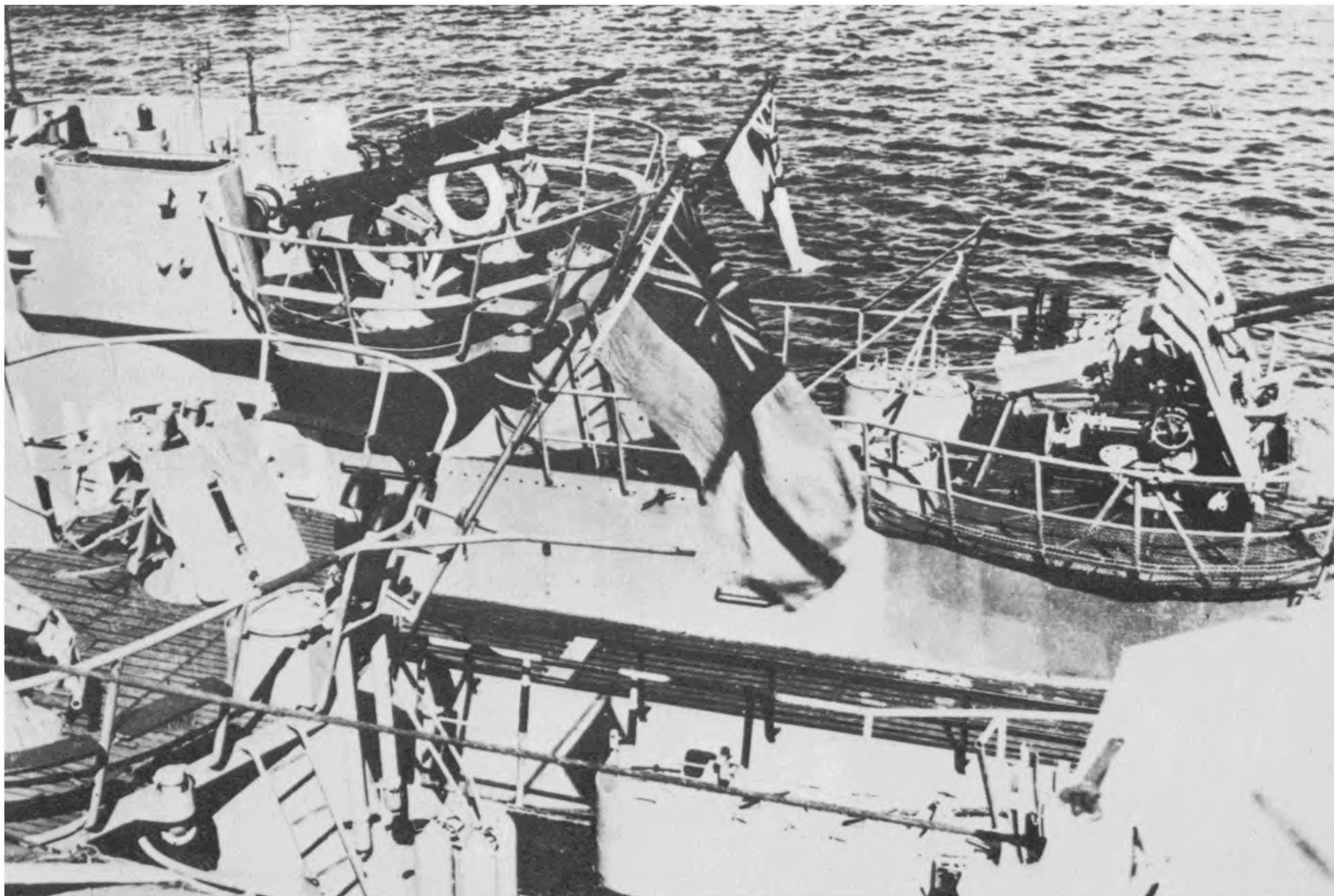
20. The attack periscope standard. Hanging on its side is a signal lamp, and a pair of Zeiss binoculars can be seen mounted on the fore bridge on a pelorus. The boat is in harbour and the crew is enjoying a smoke break. The boat is *U 99*, a Type VIIB (see also Frontispiece). She was lost in 1941 to the depth charges of HMS *Walker*, south east of Iceland.

21. This stern view of *U 1168*, taken in 1945, shows the whole of the 'Wintergarten' aft of the bridge. In the background are the twin 2cm mountings, and in the foreground the twin 3.7cm Flak and shield.

22. Launched in July 1944, *U 1305* was eventually taken by the Russians as war booty, and commissioned in the Soviet Navy as *S 84* until she was broken up in 1963. The life raft containers are visible on the bow casing, and the general silhouette is quite clear. From the attitude of the gunner at the 20mm Oerlikon in the foreground, as well as the 3.7cm Flak barrel angle, it seems that this picture was taken as she surfaced to surrender.

23. Another, better, view of the 'Wintergarten' as *Us 190* and *889* lie alongside after surrender. The twin 3.7cm mounting is particularly clear on the far boat, as are the twin 2cm fittings nearer the bridge. The casing for the FuMO 61 is also visible.

24. The last voyage: a Type VIIC (1944 equipment) is seen sailing to be scuttled by a scratch Royal Navy crew during Operation 'Deadlight'.
All uncredited photographs BfZ.



23



24

The Drawings

A NOTE ON THE DRAWINGS

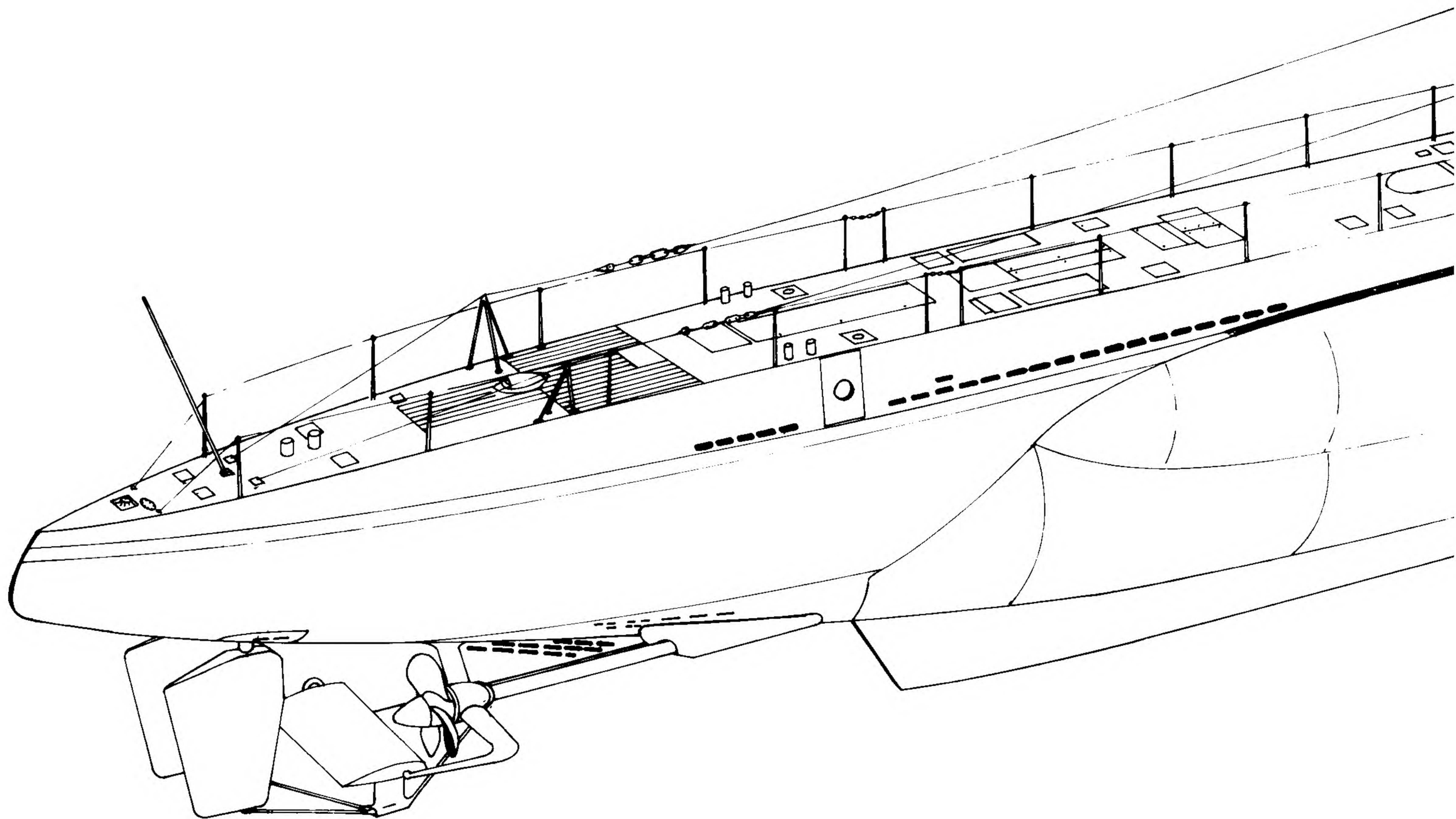
The drawings are arranged on a thematic basis. They start on the outside of the boat, and then show in a series of more detailed drawings the internal arrangements of the major variants of the Type VII design. These drawings are followed in turn by even more detailed presentations of the compartments into which structurally the boats were divided. These compartments were the result of both naval and building requirements, and each is shown in considerable detail. There are also a number of perspective drawings of the interior and exterior of the boats – drawings done with the modeller specifically in mind. There are also a number of drawings showing weapons (guns and torpedoes in particular). As noted above, the towers of the Type VII boats underwent a considerable number of changes, and even the *official* list includes seven main modifications. Considerable space is devoted to these, as the tower was

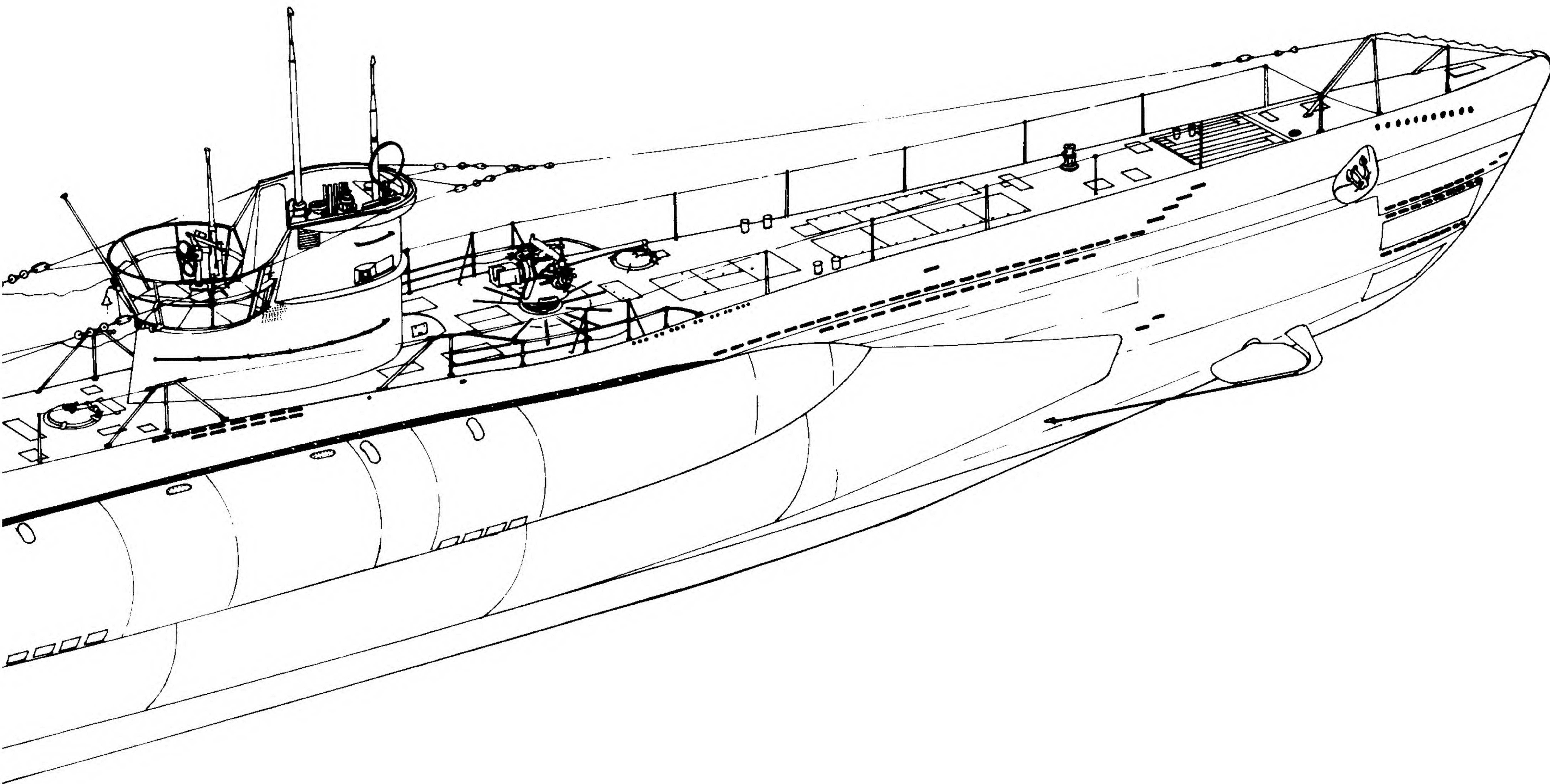
the most easily recognisable part of these boats when they were surfaced. Almost all of the basic drawings have been taken from original plans, or from drawings made after the war, in themselves taken from German originals. Many of the other drawings have been done after detailed research into photographs of actual boats. Further drawings (marked as *U 995*) were done after the author's research in Laboë and Hamburg. The reader may like to know that *U 995* is preserved as a memorial to the German U-boat Arm at Laboë, some 18 kilometres from Kiel. She is well worth a visit, the results of which will reward anyone interested in the subject, and armed with a plentiful supply of film and flash bulbs. Most drawings are scaled to 1/200 or 1/100, with the exception of the perspectives and details which are produced at a scale to give maximum clarity.

}

A General arrangement – external

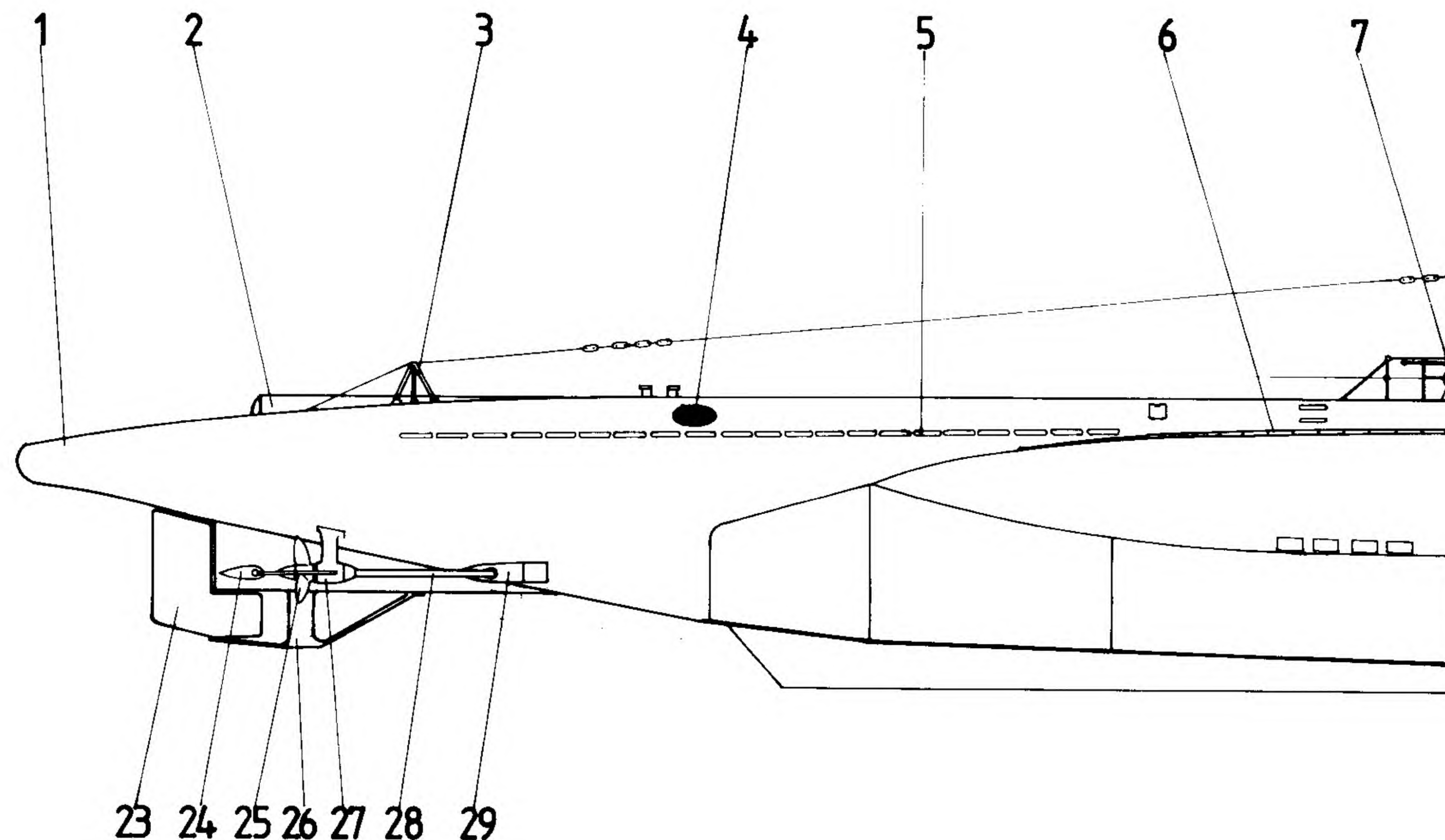
A1 TYPE VIIC AS IN 1936 (the boat is
as rigged for harbour)

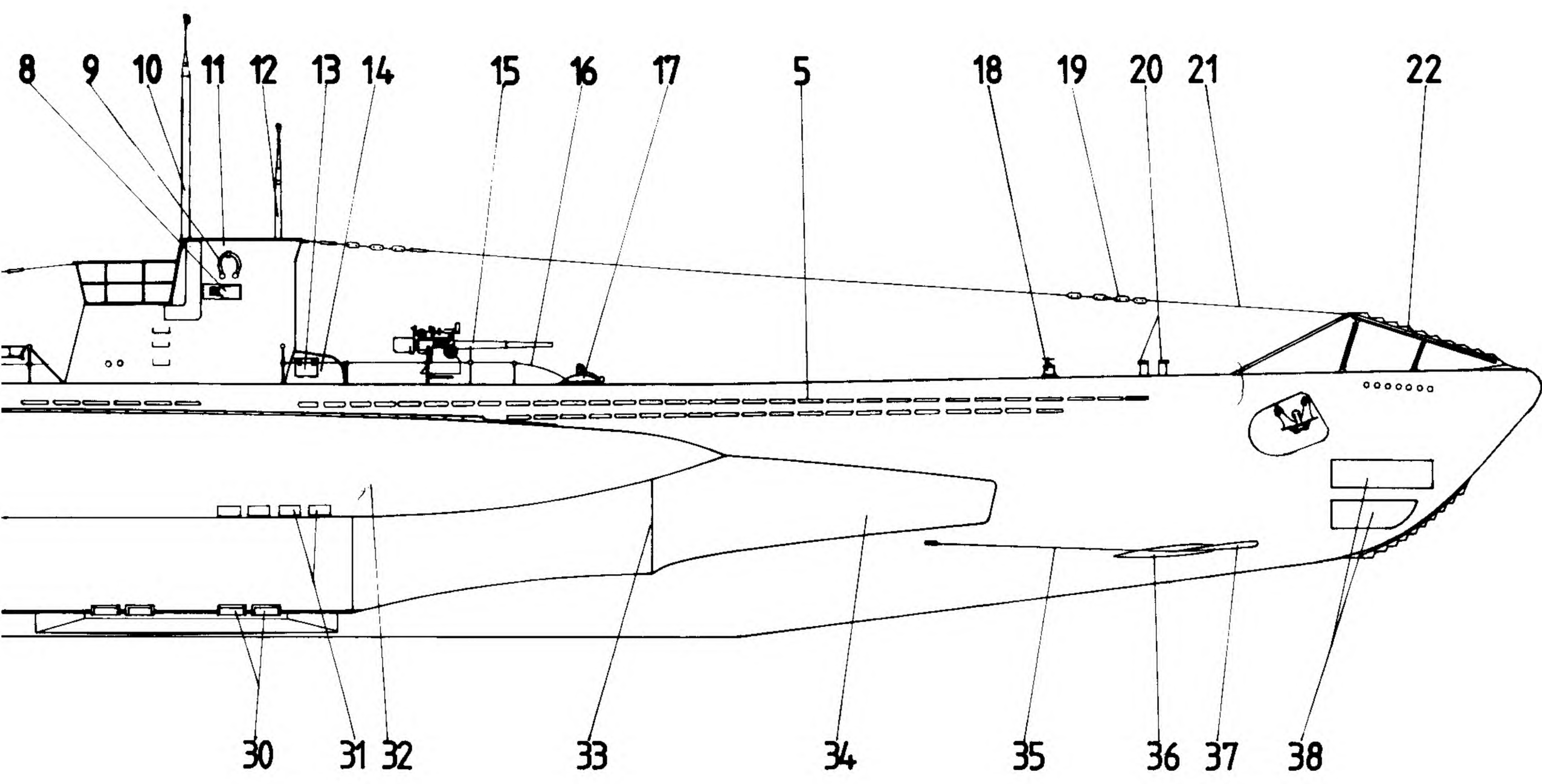




A General arrangement – external

- A2 TYPE VII AS IN 1936–39 (scale 1/200 unless otherwise indicated)**
- 1 Stern casing
 - 2 External stern torpedo tube
 - 3 Starboard stern aerial support
 - 4 Diesel exhaust
 - 5 Drainage slots, after casing
 - 6 Drainage slots, central casing
 - 7 2cm C30 FlaK cannon
 - 8 Starboard navigation light
 - 9 Life belt
 - 10 Attack periscope
 - 11 Tower casing
 - 12 Control room periscope
 - 13 Access hatch to magnetic compass
 - 14 Main magnetic compass housing
 - 15 8.8cm C35 main deck gun
 - 16 Fixed railing
 - 17 8.8cm watertight ready-use ammunition container
 - 18 Capstan head (removable at sea)
 - 19 Aerial insulators
 - 20 Bollards (removable at sea)
 - 21 Aerial stay wire
 - 22 Net cutter (and below bow)
 - 23 Single central rudder
 - 24 Aft hydroplane (port and starboard)
 - 25 Propeller (port and starboard)
 - 26 Rudder support
 - 27 Propeller shaft bracket and gland
 - 28 Propeller shaft (port and starboard)
 - 29 Propeller shaft hull housing and gland
 - 30 Inlets for main (internal) diving tank
 - 31 Inlets for diving tanks 2 and 3
 - 32 Saddle-tank
 - 33 Weld lines on pressure hull
 - 34 Fore part of pressure hull
 - 35 Fore hydroplane tensioner
 - 36 Fore hydroplane
 - 37 Fore hydroplane fairing
 - 38 Bow torpedo tube casing doors



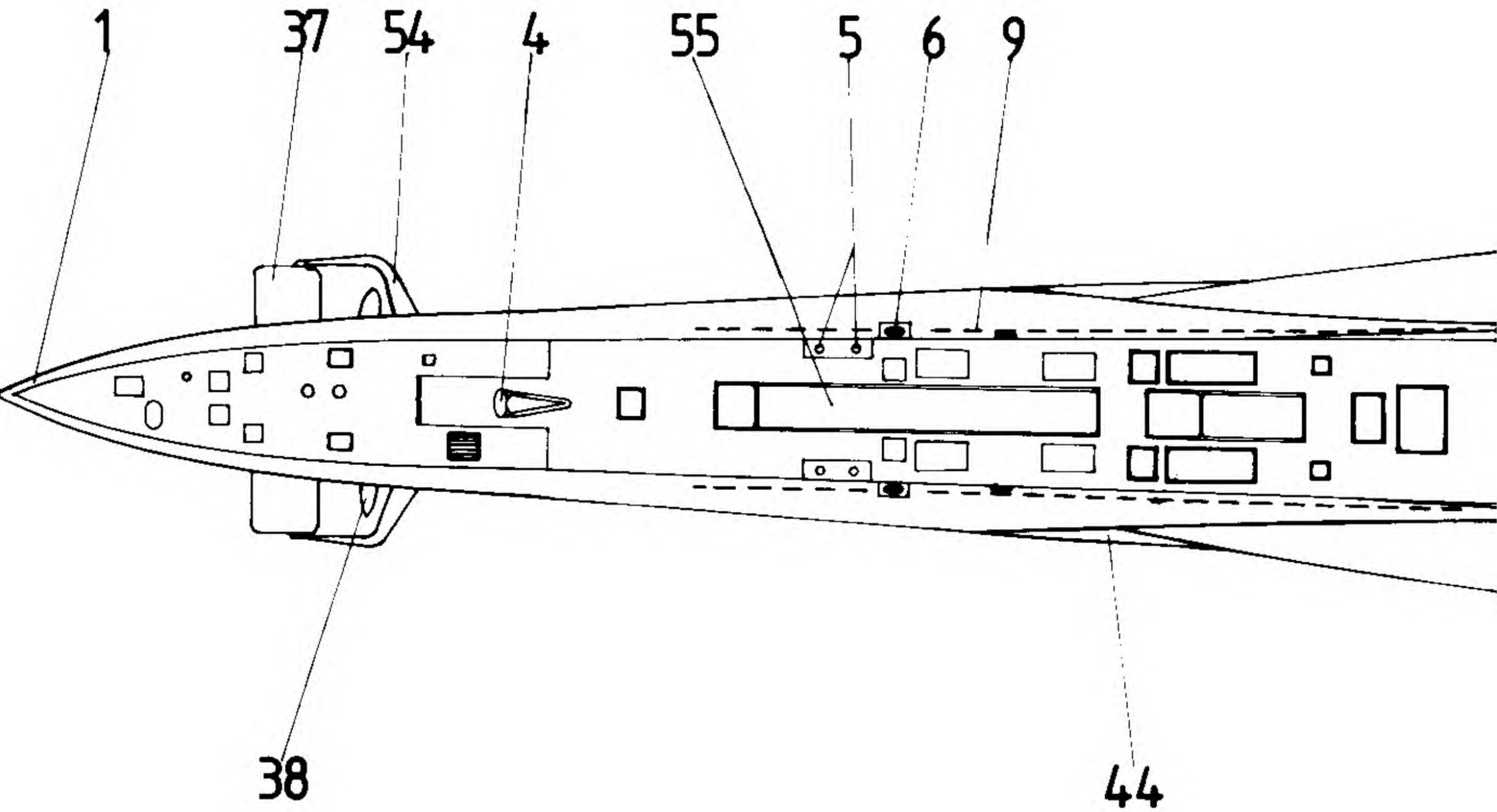
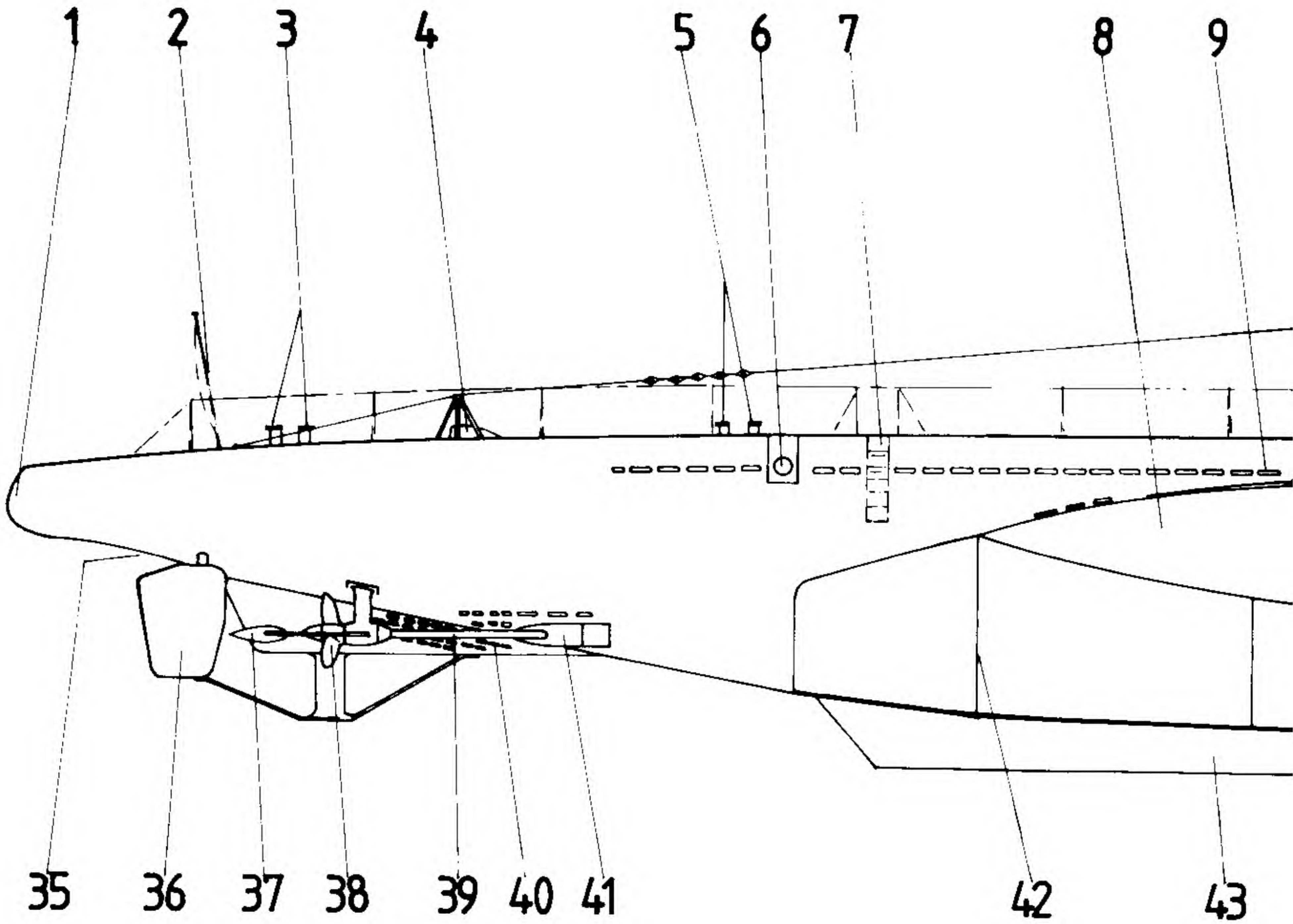


A 2

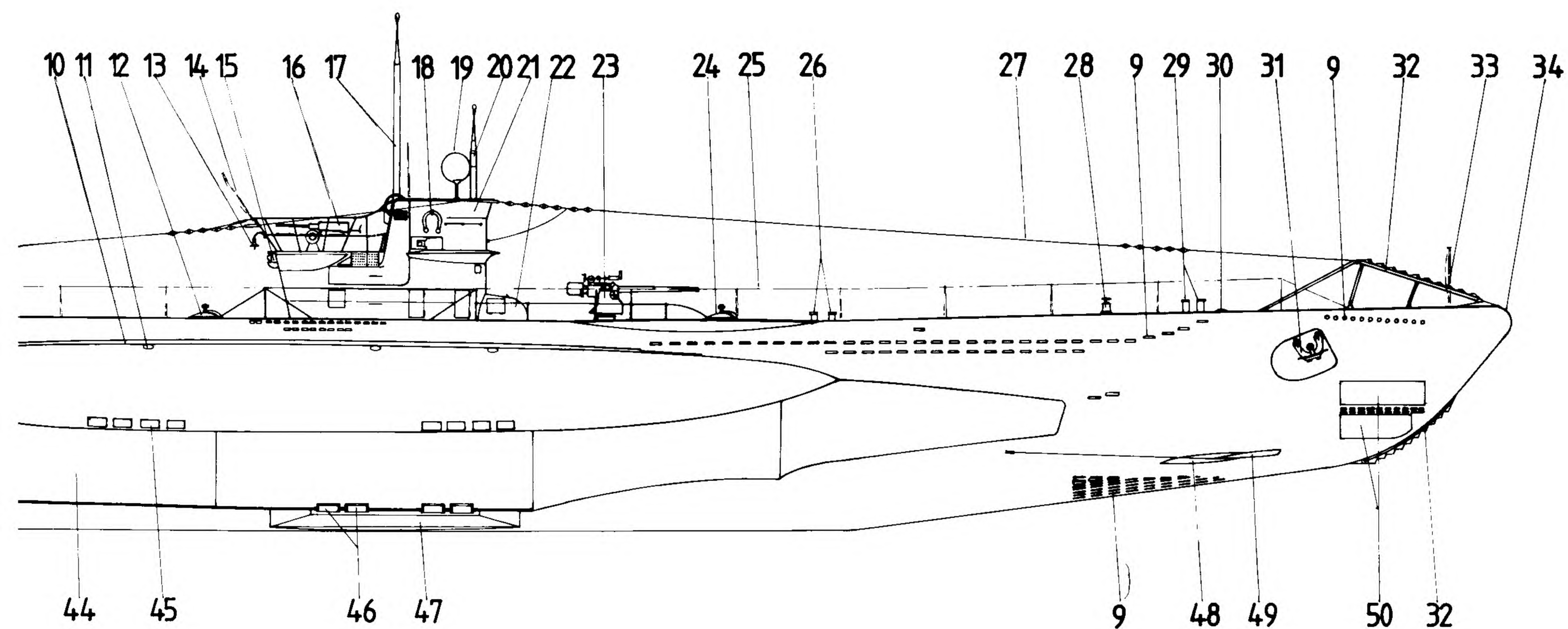
A General arrangement – external

A3,A4 TYPE VIIB AS IN 1940 (elevation and plan)

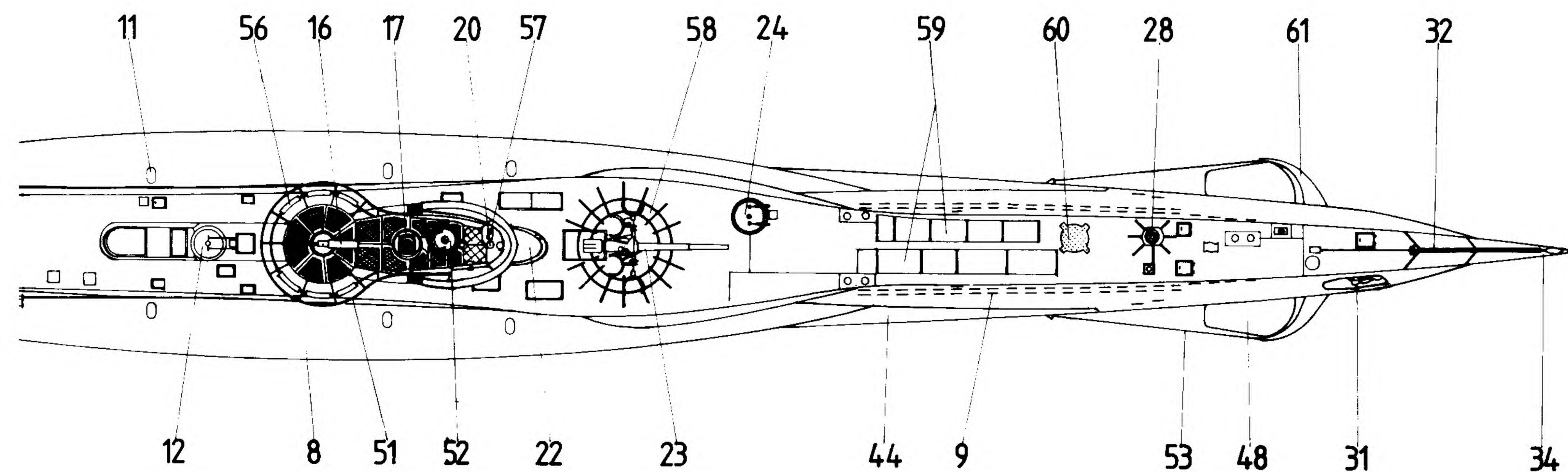
- | | | | |
|----|---|----|---|
| 1 | Stern casing | 36 | Starboard rudder |
| 2 | Ensign staff | 37 | Aft hydroplane (port and starboard) |
| 3 | Aft bollards | 38 | Propeller (port and starboard) |
| 4 | Stern navigation light | 39 | Propeller shaft |
| 5 | Rear casing bollards | 40 | Drainage slots, aft flooded casing |
| 6 | Diesel engine exhaust port | 41 | Propeller shaft housing and gland |
| 7 | Aft ladder | 42 | Weld line, pressure hull |
| 8 | Saddle-tanks | 43 | Keel |
| 9 | Drainage slots | 44 | Pressure hull, crew's compartment aft section |
| 10 | Main central casing drainage slots | 45 | Inlet valves, diving tank 2 |
| 11 | Outlet valve, diving tank 2 | 46 | Inlet valves, main (internal) diving tank |
| 12 | Watertight 2cm ready-use ammunition container | 47 | Ballast keel |
| 13 | Boat's bell | 48 | Fore hydroplane (port and starboard) |
| 14 | Flag staff | 49 | Fairing for hydroplane |
| 15 | Bridge navigation light (stern light) | 50 | Forward torpedo tube outer casing doors (port and starboard) |
| 16 | 2cm C30 FlaK cannon | 51 | Bridge platform guard rails |
| 17 | Attack periscope | 52 | Bridge hatch |
| 18 | Life belt | 53 | Fore hydroplane tensioner |
| 19 | DF (direction-finding) aerial | 54 | Aft hydroplane fairing |
| 20 | Control room periscope | 55 | Aft reserve torpedo container access hatches |
| 21 | Bridge casing | 56 | Bench-type rests for crew (when boat on the surface at sea) |
| 22 | Magnetic compass housing | 57 | Command telephone, bridge |
| 23 | 8.8cm C35 main deck gun | 58 | Main gun ring, with anti-slip ridges for gun crew |
| 24 | 8.8cm watertight ready-use ammunition container | 59 | Fore access hatches to reserve torpedo container (starboard), and dinghy (port) |
| 25 | Dismountable deck safety railing (wire) | 60 | Alarm buoy, released from inside pressure hull if U-boat sunk |
| 26 | Forward casing bollards | 61 | Fore hydroplane fairing |
| 27 | Radio aerial (insulators shown) | | |
| 28 | Capstan head (removable at sea) | | |
| 29 | Bow bollards | | |
| 30 | Access to anchor windlass | | |
| 31 | Anchor (starboard only) | | |
| 32 | Net cutter | | |
| 33 | Jack staff | | |
| 34 | Bow casing | | |
| 35 | Aft torpedo tube housing and door | | |



A3



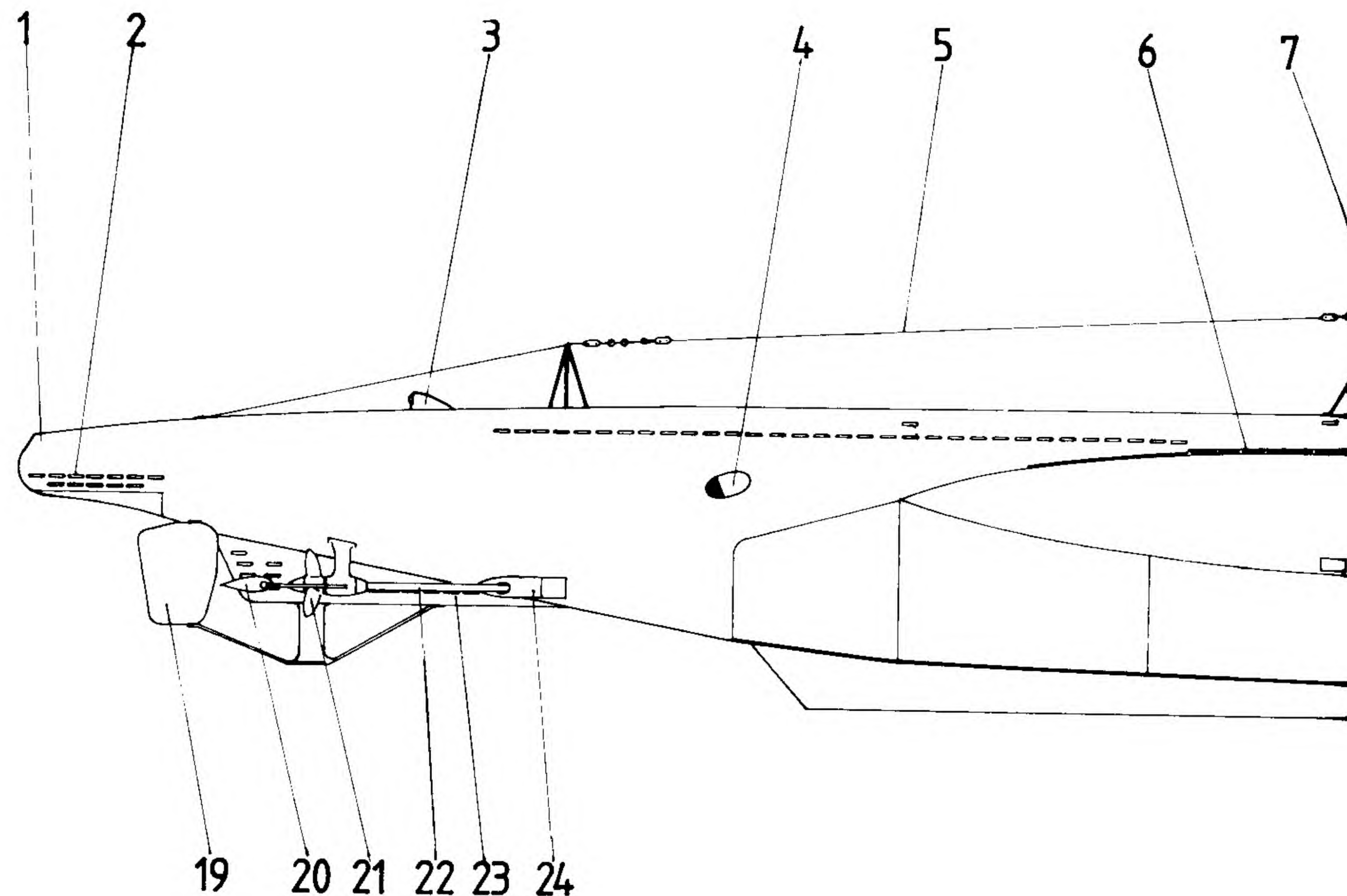
A4



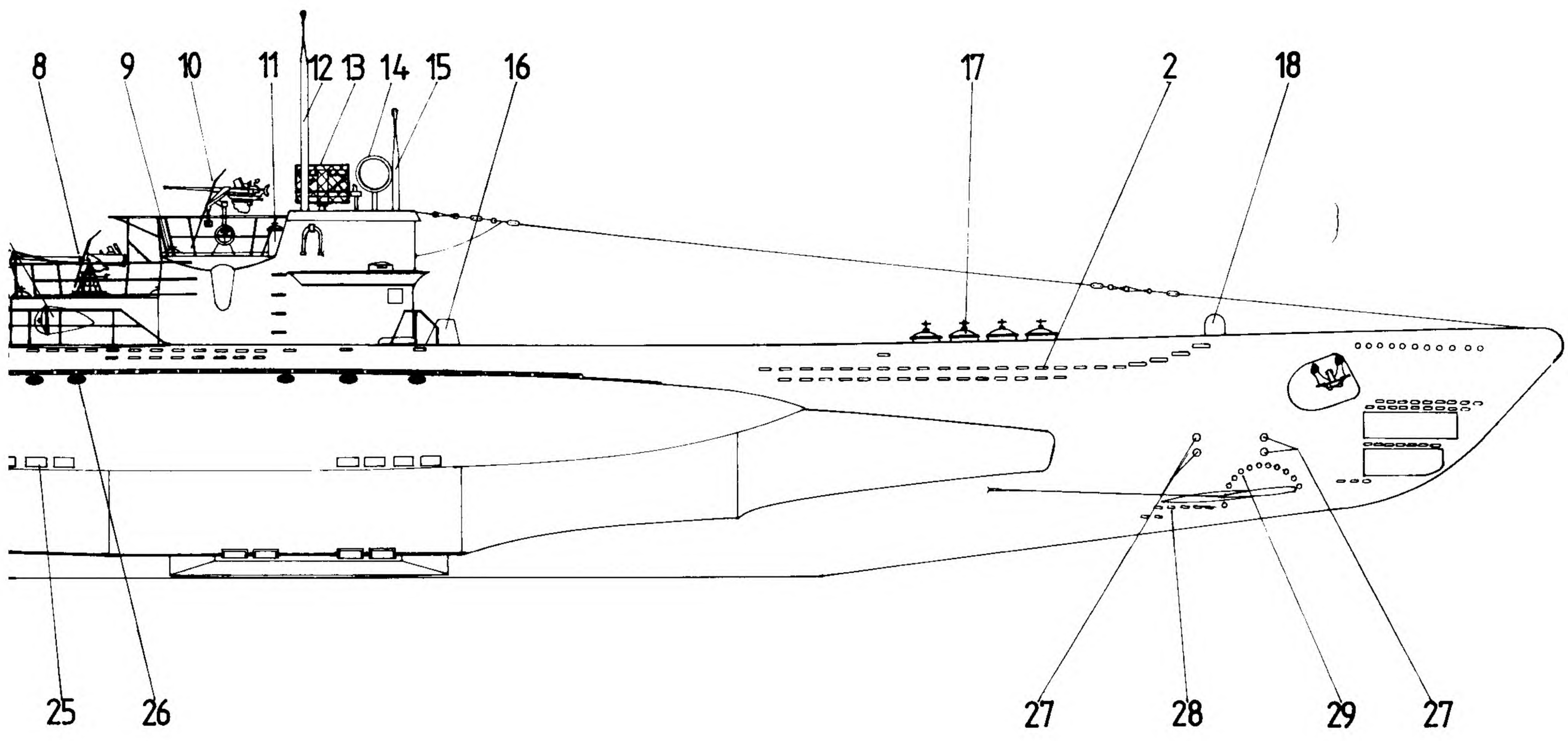
A General arrangement – external

A5/1 TYPE VIIC AS IN 1944 (elevation)

- 1 Stern casing
- 2 Inlet/outlet slots, after casing
- 3 Stern navigation light
- 4 Diesel exhaust outlet (below waterline) for surface running
- 5 Radio aerial
- 6 Main casing flooding slots
- 7 Ready-use watertight ammunition containers, 3.7cm ammunition
- 8 3.7cm M42U FlaK cannon on LM 42 U mounting
- 9 2cm ammunition watertight ready-use ammunition container
- 10 2cm twin 38 MII FlaK cannon in twin LM 43 U mounting (port and starboard)
- 11 Main 2cm watertight ready-use ammunition container
- 12 Attack periscope
- 13 FuMO 61 and aerial type 6 for DF set
- 14 Aerial for DF set
- 15 Air search periscope
- 16 Magnetic compass housing
- 17 Watertight containers (four) for 5 man inflatable life rafts
- 18 Housing for KDB (Kristalldrehbasisgerät) rotating signal detector
- 19 Rudder (port and starboard)
- 20 Starboard aft hydroplane
- 21 Starboard propeller
- 22 Propeller shaft
- 23 Aft lower casing drainage slots
- 24 Propeller shaft housing and gland
- 25 Inlet valves for diving tank 2 (forward valves for tank 3)
- 26 Outlets, diving tank 2 (forward outlets for tank 3)
- 27 UT microphones (underwater sound location equipment)
- 28 Drainage slots, forward free-flooding casing
- 29 GHG microphone array (port and starboard)



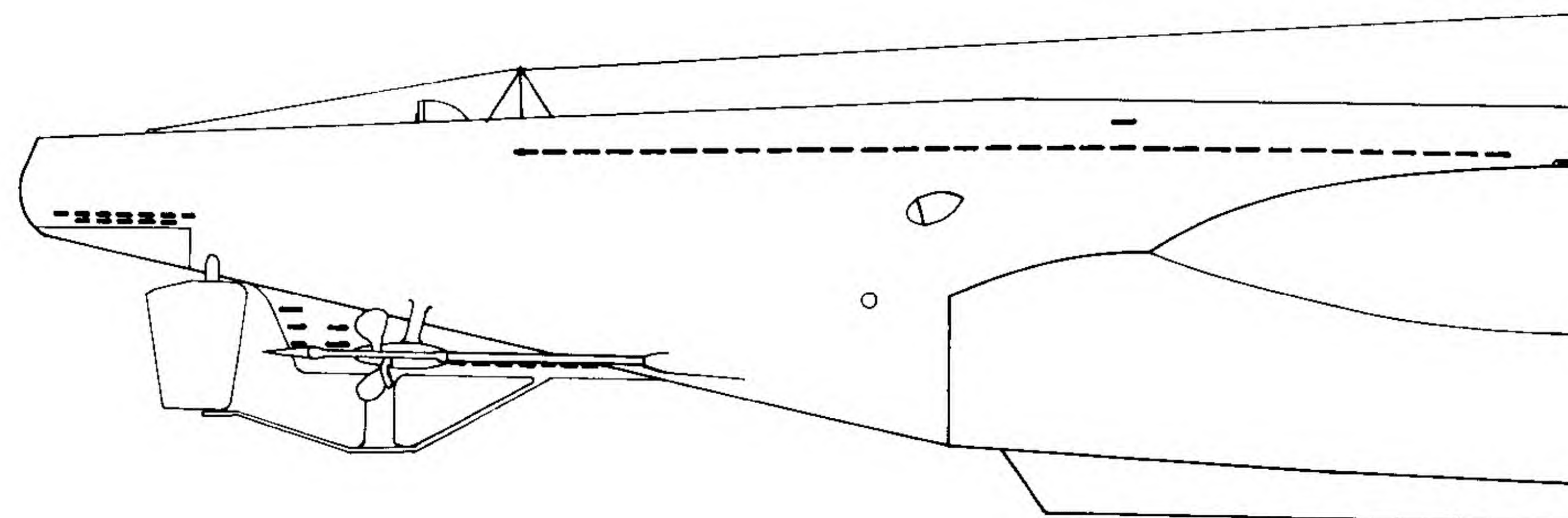
A5/1



A General arrangement – external

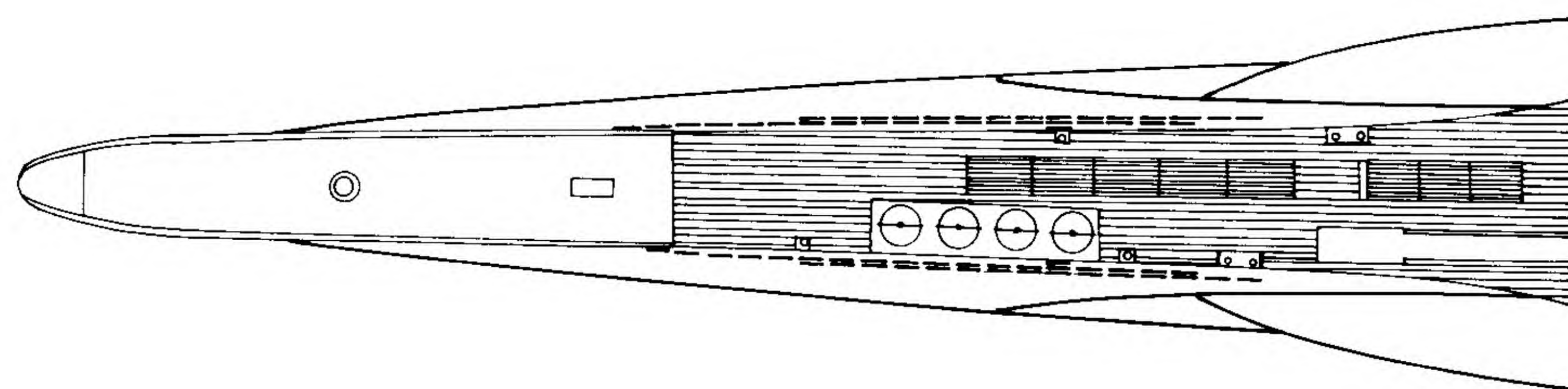
A5/2 TYPE VIIC/41 (elevation)

This drawing shows *U 995* as she appeared in the last two years of the war, when she operated on the Arctic Front. In the last year of the war she was fitted with the *Balkon Gerät*, which can be seen below her bow; this was yet one more German attempt to upgrade sound location for the U-boats to allow them to find their targets, the convoys. Once more, although sophisticated, this equipment came too late and in far too small numbers to have any effect on the overall conduct of the war.

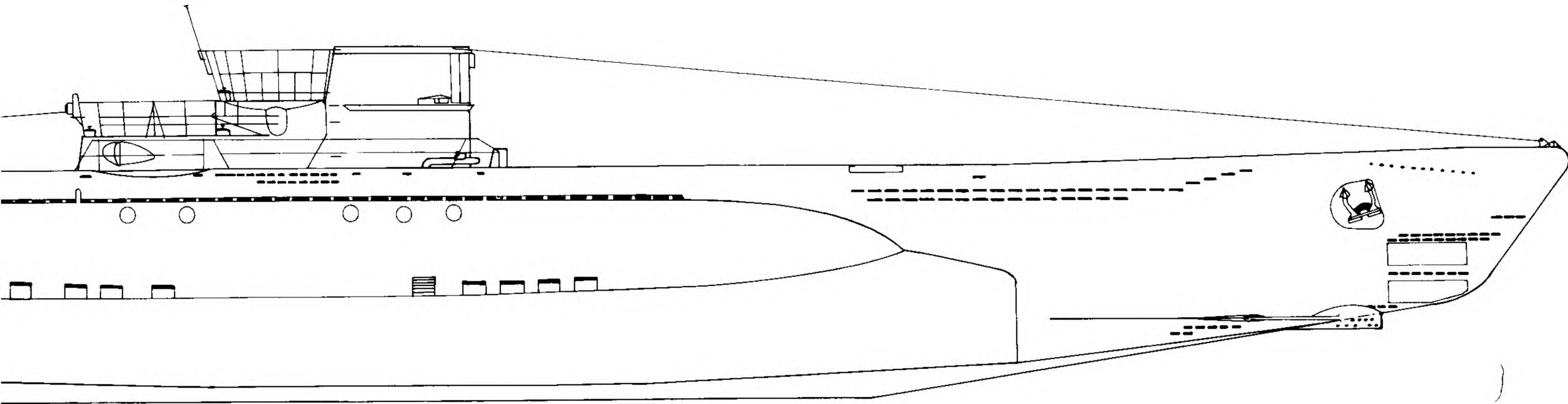


A5/3 TYPE VIIC/41 (deck plan)

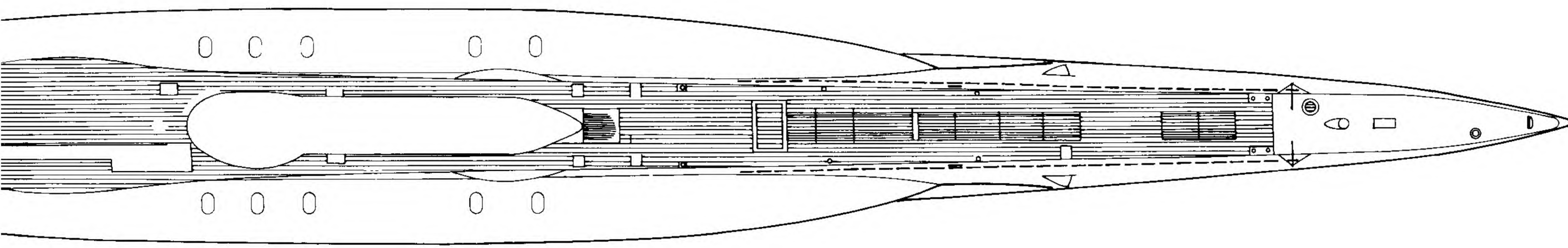
This plan shows the enlarged tower, made necessary by the extra FlaK installations on the upper and lower 'Wintergarten', as well as the wooden decking. This became a more frequent item on the U-boats as the war progressed, for German steel requirements were such that economies had to be made – and U-boat decks were one of these economies.



A5/2

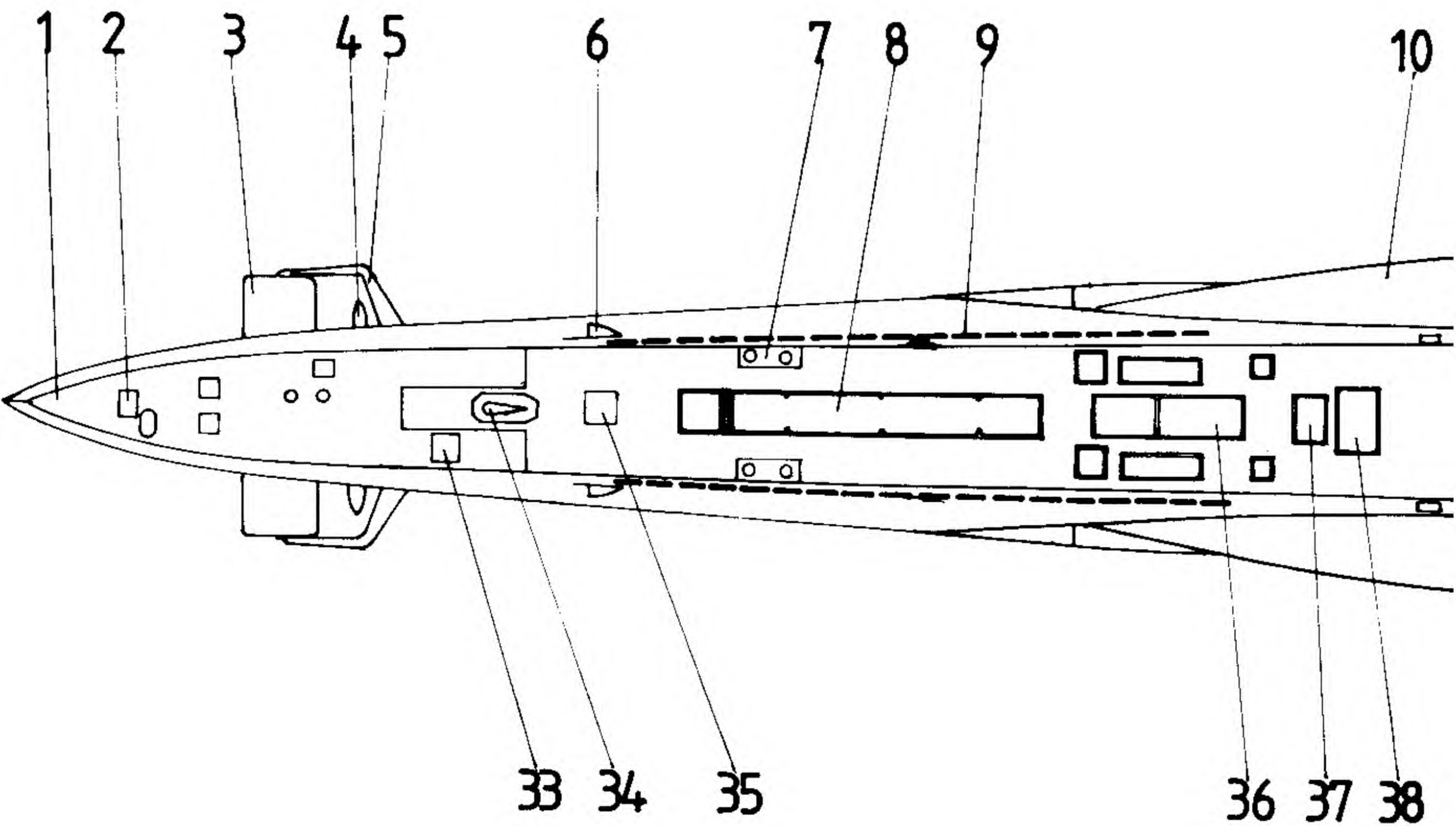


A5/3



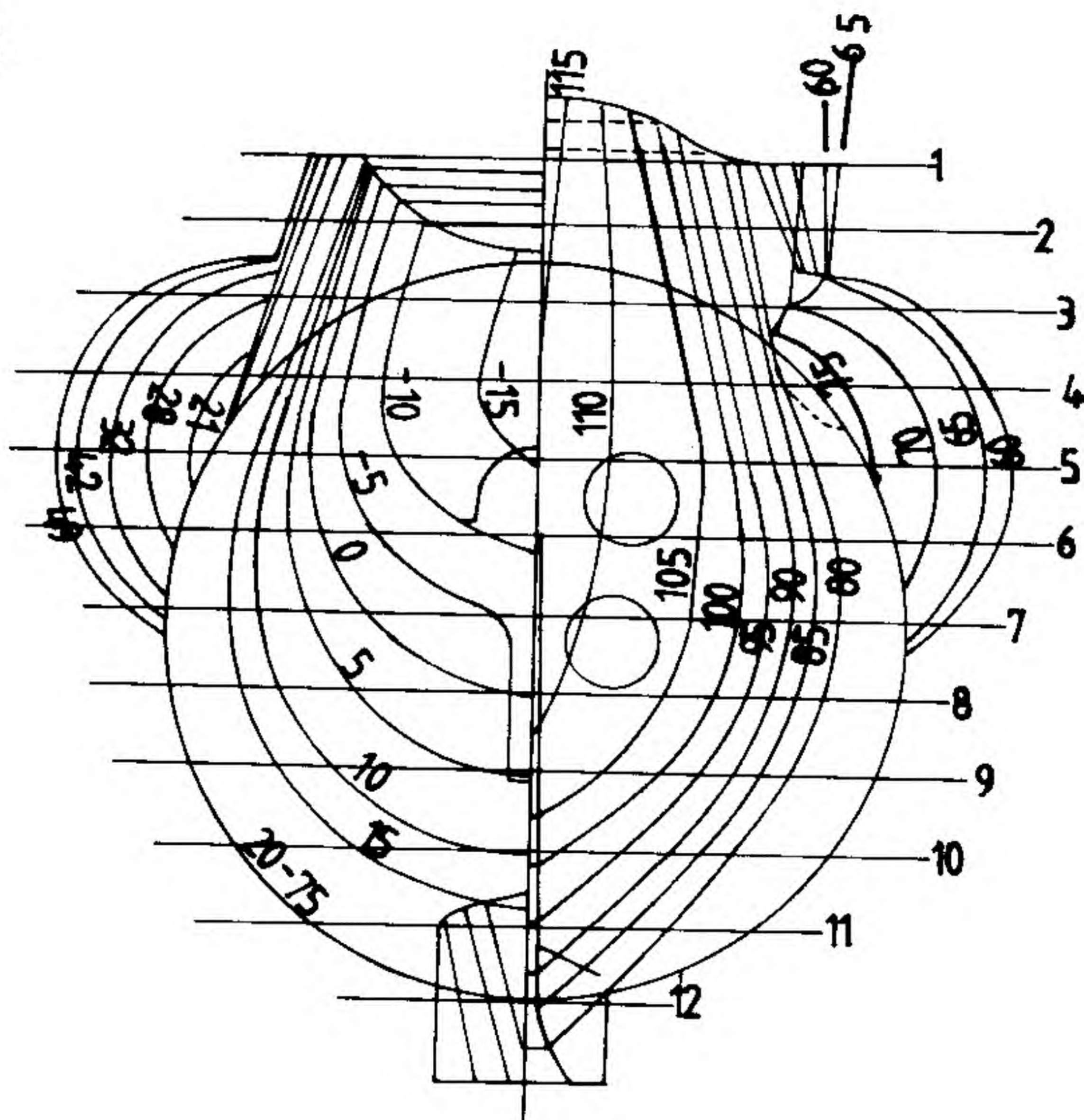
A General arrangement – external

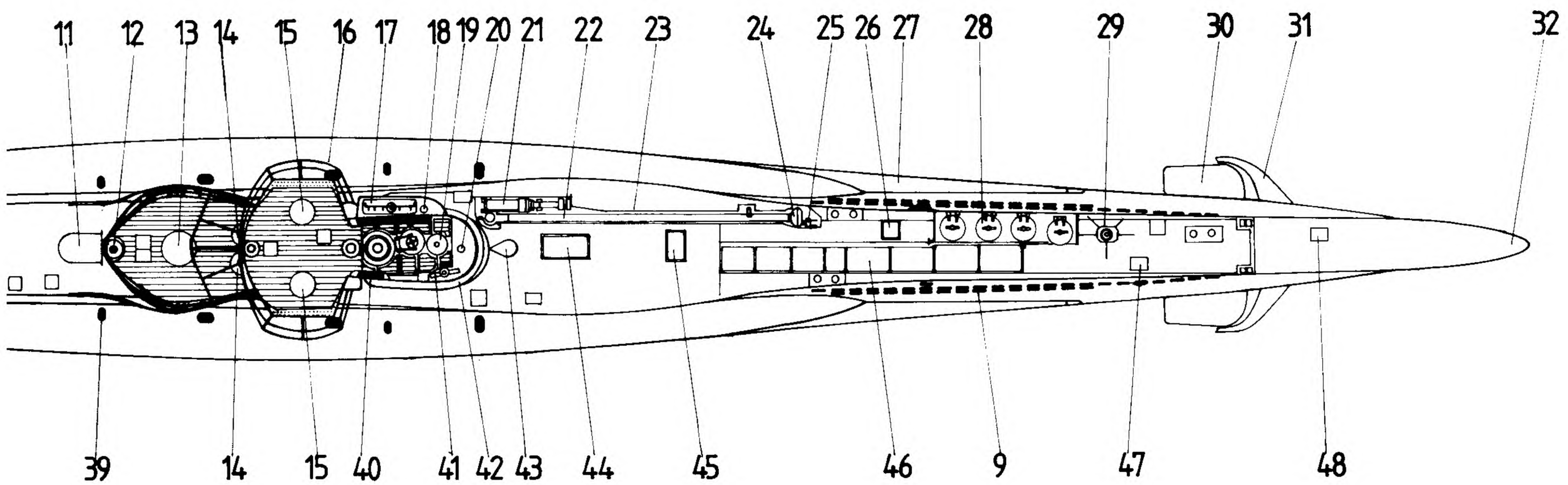
A6/1	TYPE VIIC AS IN 1944 (deck plan)		
1	Stern casing	25	Aerial type 3 for FuMB
2	Access to stern watertight compartment	26	Access hatch to compressed air supply
3	Port after hydroplane	27	Pressure hull
4	Port propeller	28	Watertight containers for 5 man inflatable life rafts
5	Port after hydroplane fairing	29	Capstan head
6	Exhaust outlet for port diesel engine (surface running)	30	Fore hydroplane
7	Bollards (removable at sea)	31	Fairing for hydroplane
8	Stern casing reserve torpedo store access hatches	32	Bow casing
9	Drainage slots (after casing spaces)	33	Access hatch to outlet valve, diving tank 1
10	Saddle-tank	34	Stern navigation light
11	Access hatch to galley (watertight hatch door)	35	Access hatch to rudder control gear
12	Watertight ready-use ammunition container (normally 2cm ordnance)	36	Access to after torpedo loading hatch
13	Pedestal for gun mounting	37	Access hatch to diesel air inlet valve
14	Ready-use ammunition container (2cm)	38	Access hatch to diesel exhaust valves
15	Pedestal for automatic cannon	39	Flooding/blowing vents for diving tank 2
16	Fixed railings for upper and lower gun platforms ('Wintergarten')	40	Air inlet for diesel air masts
17	Housing for FuMB aerial	41	Aerial for FuMB 26
18	Long wave radio aerial housing	42	Bridge spray deflector
19	Base for attack sight	43	Main magnetic compass housing
20	Air search periscope sleeve	44	Access hatch to Schnorchel trunking
21	Schnorchel elevating piston	45	Battery loading hatch
22	Schnorchel tube (air intake and exhaust)	46	Fore reserve torpedo store access hatches
23	Housing for Schnorchel	47	Access hatch to anchor motor
24	Schnorchel head	48	Access hatch to anchor windlass



A6/2 TYPE VIIC BODY PLAN (the drawing shows the aspect from astern, on the left, and from forward. The numbers indicate the distance of the form line from the aft perpendicular; 1/100 scale)

A6/2

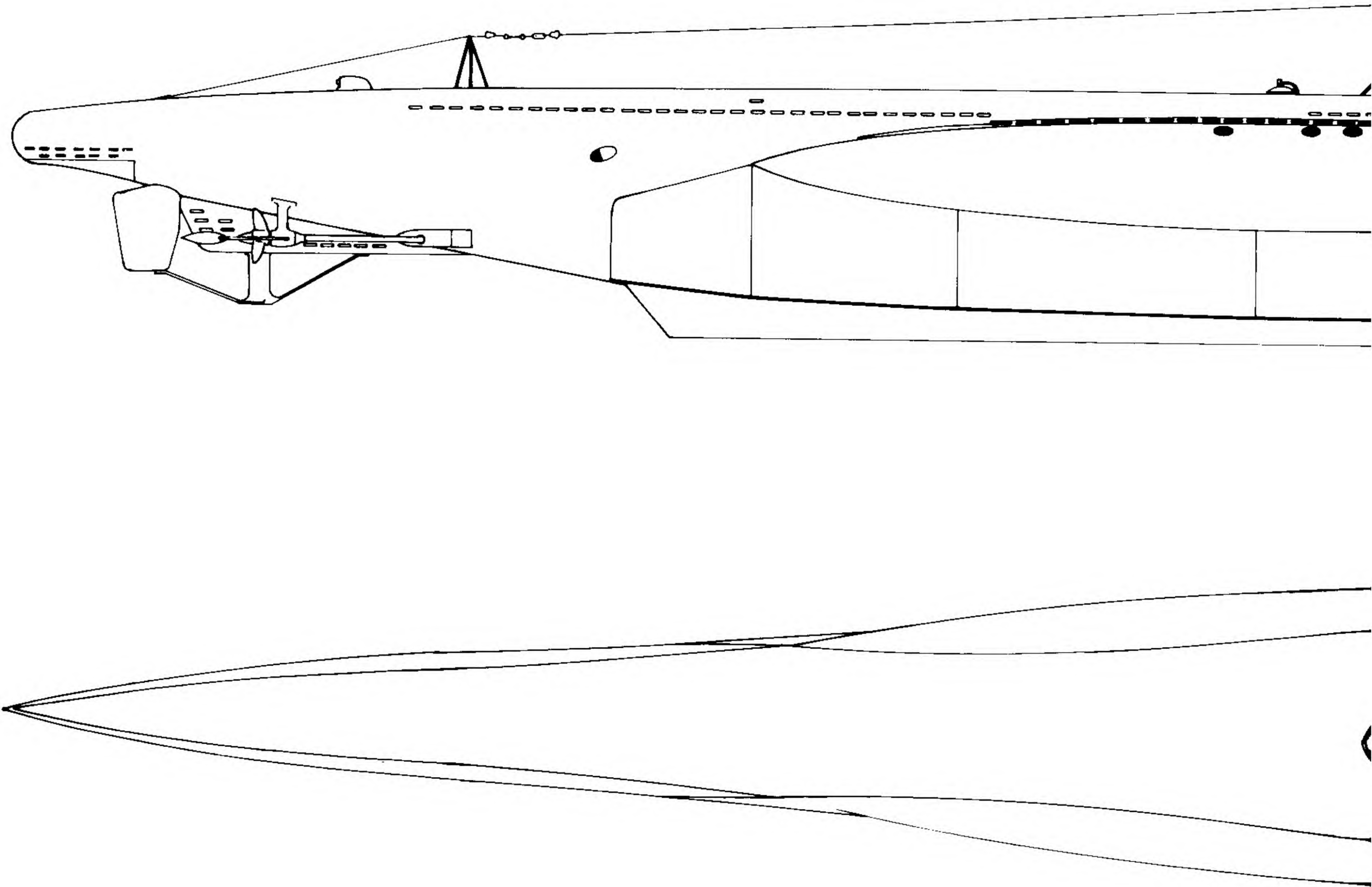


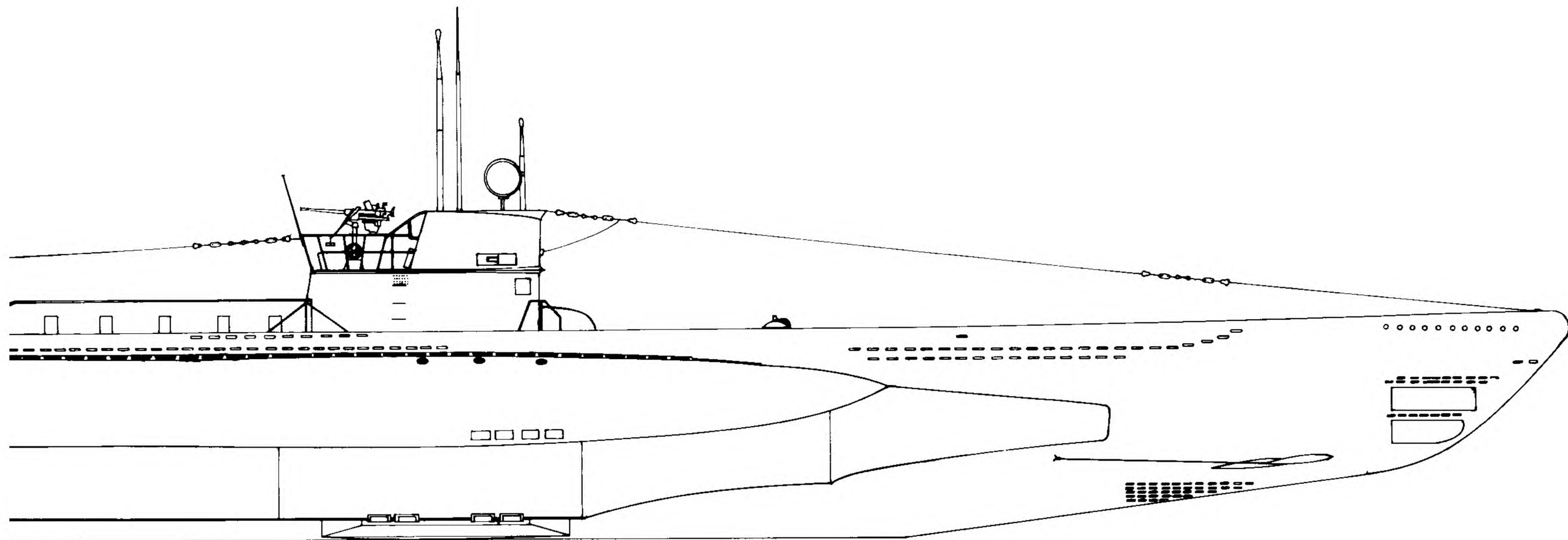


A6/1

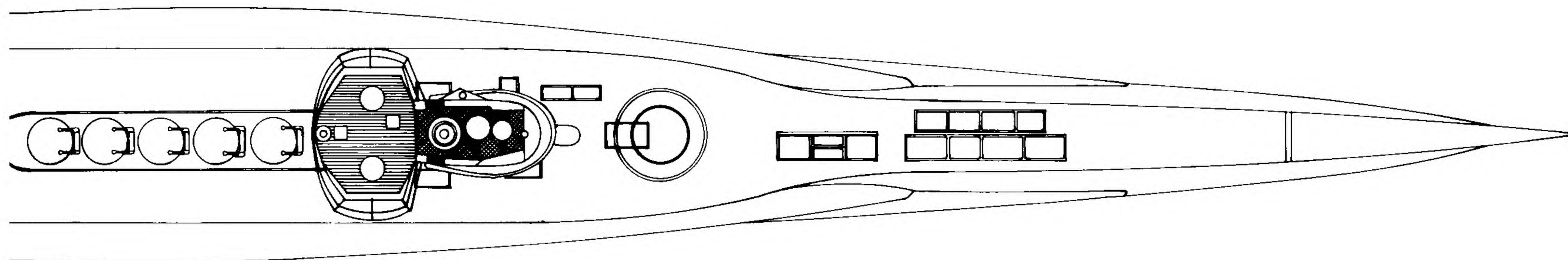
A General arrangement – external

A7, A8 TYPE VIID AS IN 1942 (elevation and plan)





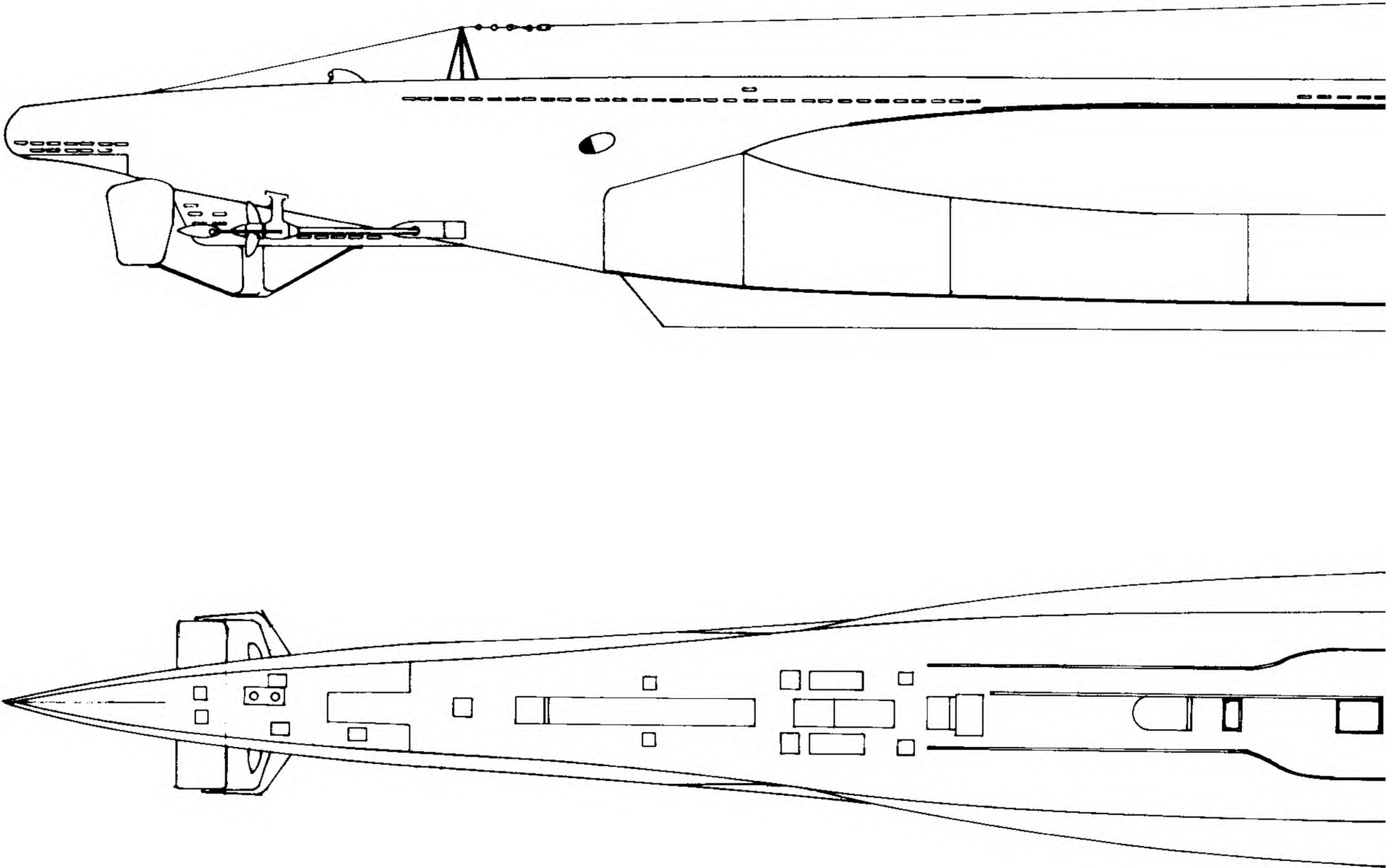
A7



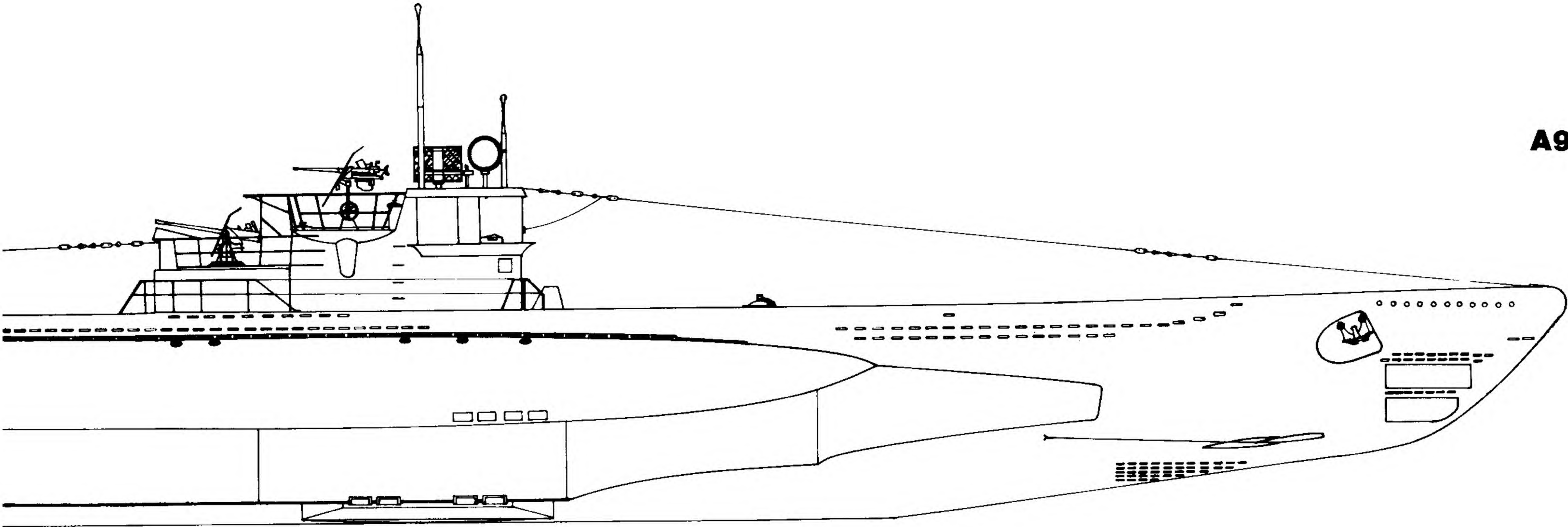
A8

A General arrangement – external

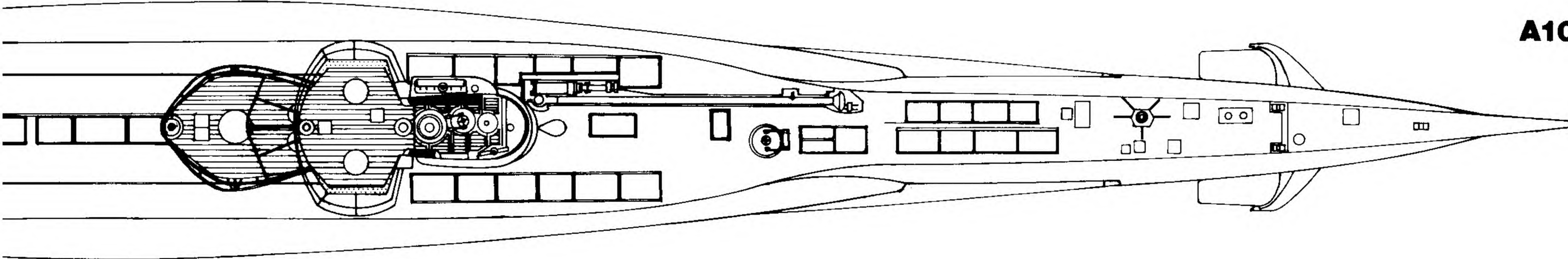
A9, A10 TYPE VIIF AS COMPLETED
(elevation and plan)



A9

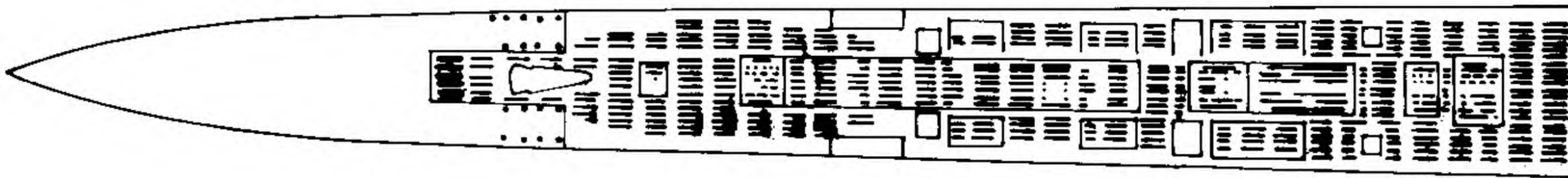


A10



A General arrangement – external

A11 FLOODING SLOTS, OUTER CASING DECK (Type VIIB, 1940)



A12 VARIATIONS IN BRIDGE LAYOUT AND ARMAMENT

A12/1 ORIGINAL FORM (Types VII and VIIB, 1936–39)

- 1 Radio aerial
- 2 Insulators
- 3 Boat's bell
- 4 Ensign staff
- 5 Platform guard rail
- 6 Attack periscope
- 7 Bridge casing
- 8 Control room periscope
- 9 Block and tackle
- 10 Deck (outer casing)
- 11 2cm C30 FlaK
- 12 Ready-use ammunition container (watertight)
- 13 Access hatch to exhausts/air intakes for diesels and engine room
- 14 Access hatches to tower casing
- 15 Main compass housing
- 16 Access hatches to compass housing
- 17 8.8cm C35 deck gun
- 18 Fixed casing rail
- 19 Dismountable safety wire

A12/2 ORIGINAL FORM (general view; no scale)
The Type VII bridge illustrates the simple lines of the early tower. This drawing should be compared with the view of the Type VIIC/41 (A12/12).

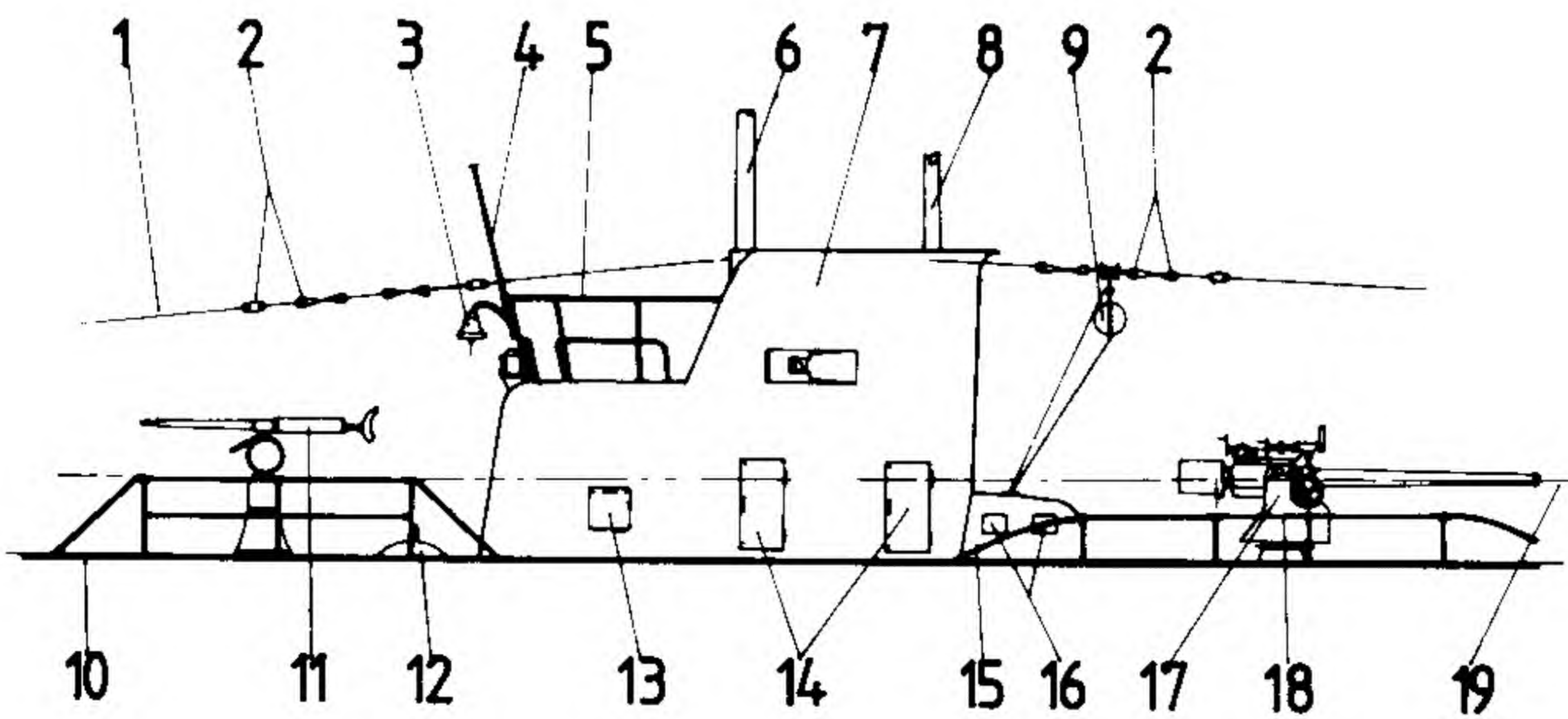
A12/3 TYPE VIIB (1940)

- 1 Deck of outer casing
- 2 Access escape hatch (to galley)
- 3 Boat's bell
- 4 Ensign staff
- 5 Gun platform railing (fixed)
- 6 2cm C30 FlaK
- 7 Attack periscope
- 8 Signalling mast
- 9 Air intake (meshed)
- 10 DF aerial
- 11 Control room periscope
- 12 Life belt
- 13 Starboard navigation light
- 14 Aerial insulators
- 15 Bridge after navigation light
- 16 Access/inspection hatch to diesel air trunking and masts
- 17 Drainage holes (bridge and gun platform)
- 18 Bridge access steps
- 19 Access hatches to tower casing
- 20 Main magnetic compass housing
- 21 Access hatch to magnetic compass housing
- 22 Wave deflector
- 23 8.8cm C35 deck gun
- 24 Watertight 8.8cm ready-use ammunition container

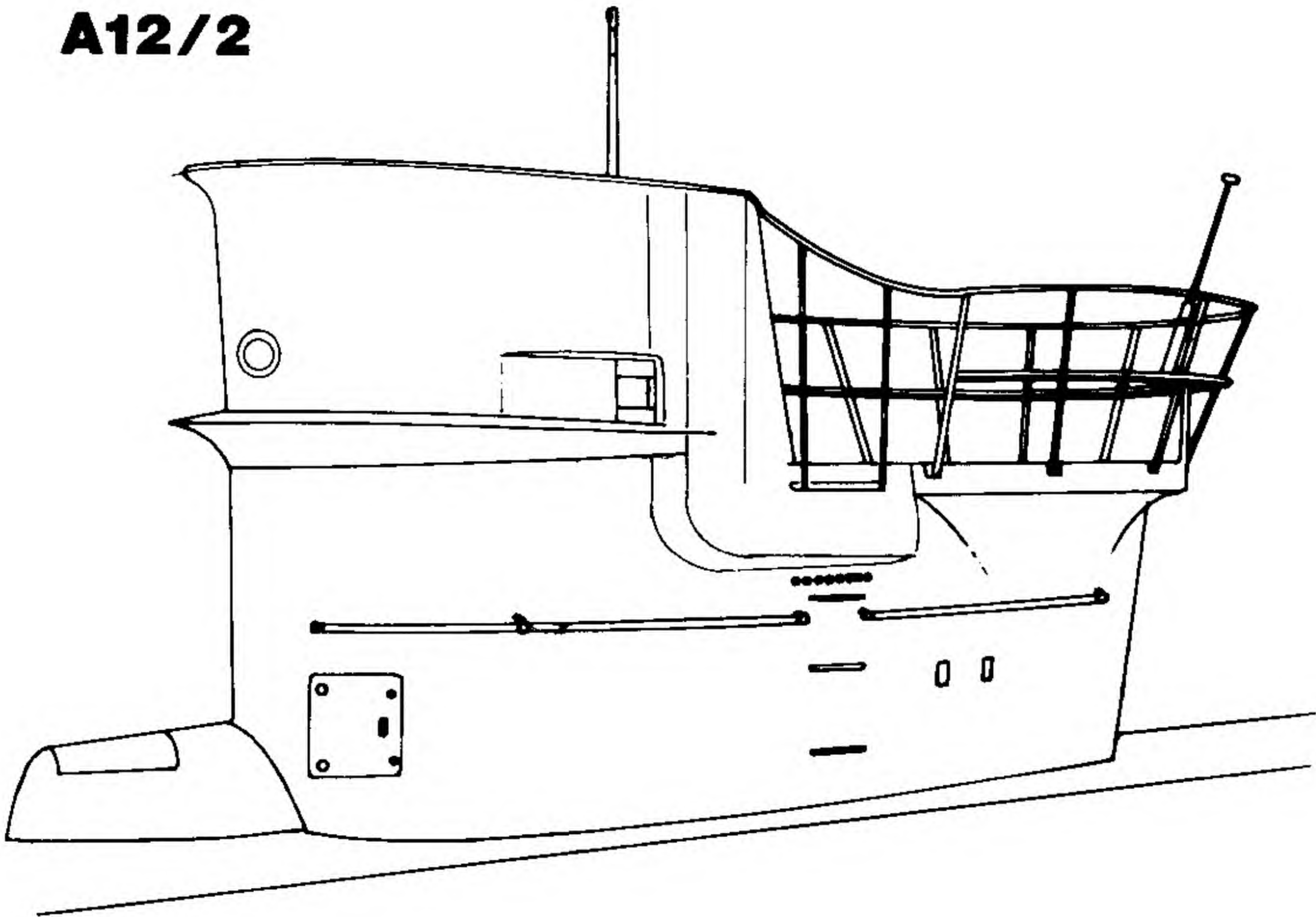
A12/4 TYPE VIIB (general view looking forward; no scale)

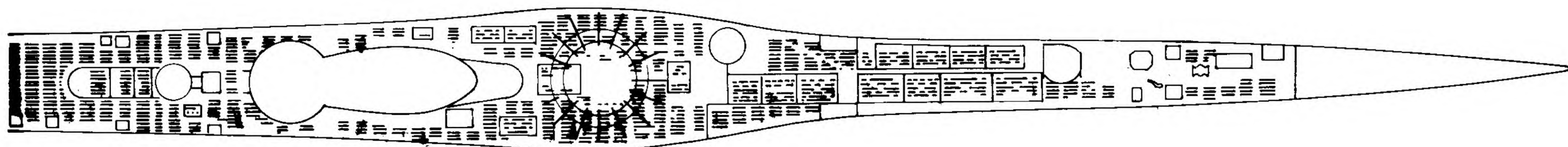
- 1 Safety rail
- 2 Lookout stand
- 3 Bridge engine revolution repeater
- 4 Compass repeater
- 5 UZO (*Unterseeboots Ziel Ortungsgerät* – submarine target sight) base
- 6 Voice pipe to control room
- 7 Attack periscope housing
- 8 DF aerial housing
- 9 Air inlet trunking
- 10 2cm FlaK pedestal

A12/1



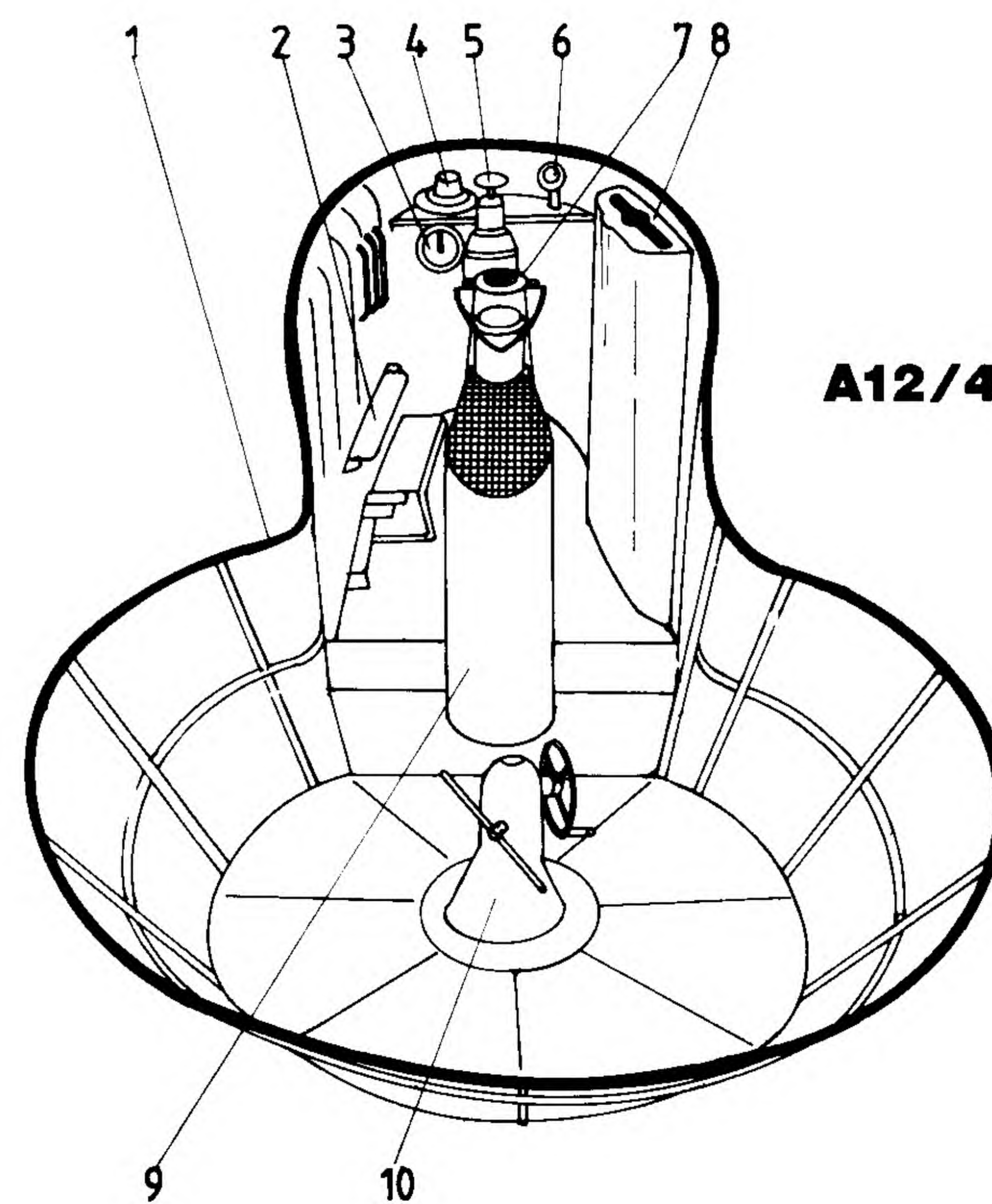
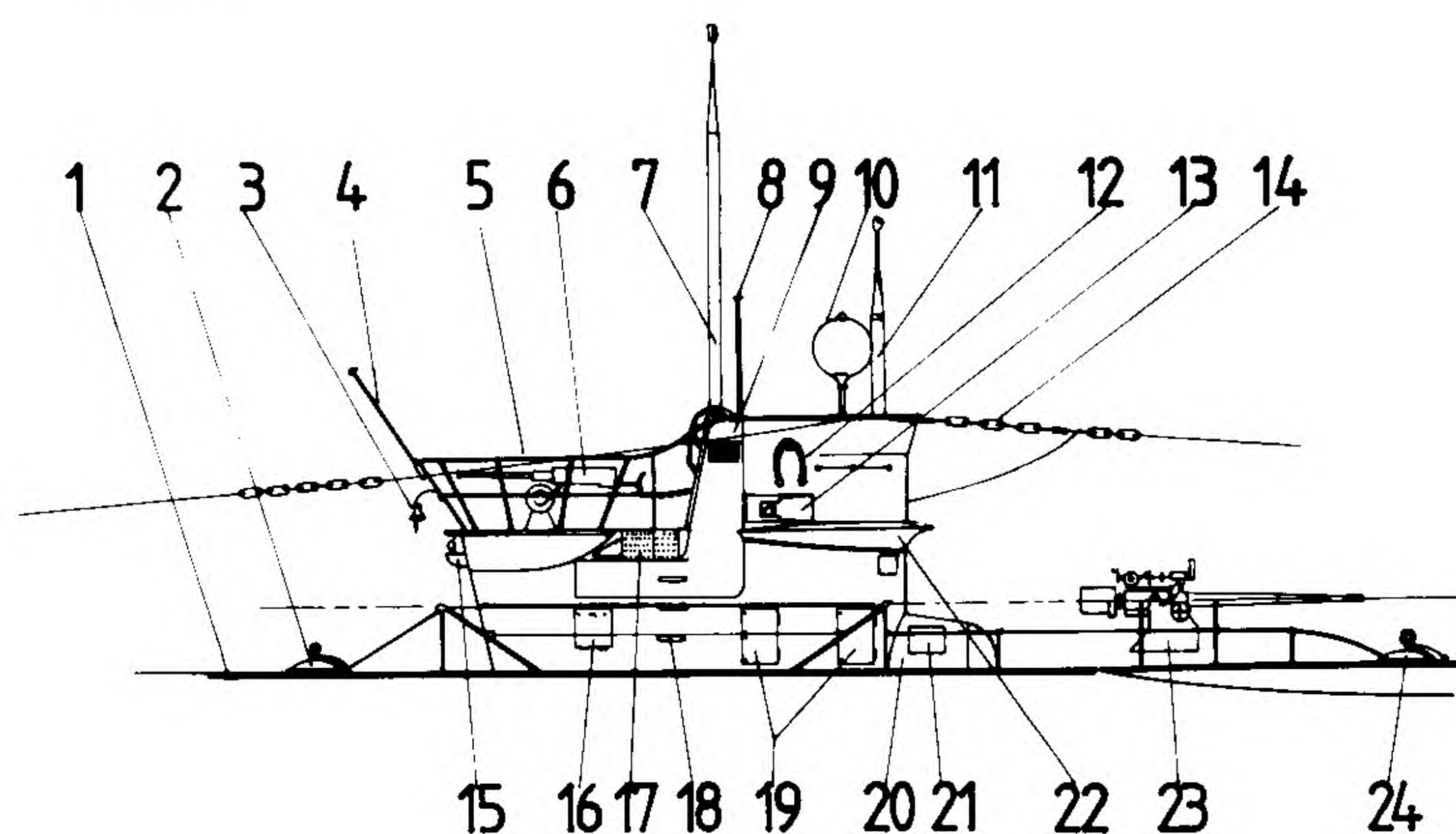
A12/2





A11

A12/3



A12/4

A General arrangement – external

A12/5 STANDARD TYPE VIIC (1940–43; from mid-1942 there were also 4–7.92mm MG C34 weapons which were mounted on spigots on the bridge)

A12/6 TYPE VIIC AS IN 1939 (general view; no scale)

- 1 Ensign staff
- 2 FlaK stand guard rail
- 3 2cm C30 FlaK
- 4 Air inlets to diesel inlet system
- 5 Attack periscope
- 6 Compass repeater
- 7 Heater
- 8 UZO (*Unterseeboots Ziel Ortungsgerät*) sighting equipment
- 9 Engine revolutions repeater
- 10 Control room/air search periscope
- 11 DF loop aerial
- 12 Bridge fairing
- 13 Ship's bell
- 14 Main bridge casing
- 15 Bridge safety hand rail
- 16 Starboard navigation light
- 17 Wave deflector
- 18 Maintenance hand rail

A12/7 MEDITERRANEAN SERVICE (1943, *Us 81 and 453*)

- 1 2cm C38 FlaK on mounting LC 30/37
- 2 Watertight container for twin Breda
- 3 Twin 13.2mm Breda heavy machine guns (port and starboard; could be stowed in a watertight container when diving or not in use)
- 4 Type 2 aerial for FuMB radar detection device ('Biscay Cross')
- 5 Lengthened gun platform to accommodate extra AA guns
- 6 Drainage holes (bridge and gun platform)
- 7 Hand rail

A12/8 MODIFICATION I (*U 84*, Type VIIB, 1943)

- 1 2cm C38 FlaK cannon on LC 30/37 mounting
- 2 Separate FlaK platform
- 3 Access ladder to gun platform
- 4 FlaK platform reinforcement
- 5 Lengthened after part of bridge
- 6 Armoured bridge plating (splinter-proof)

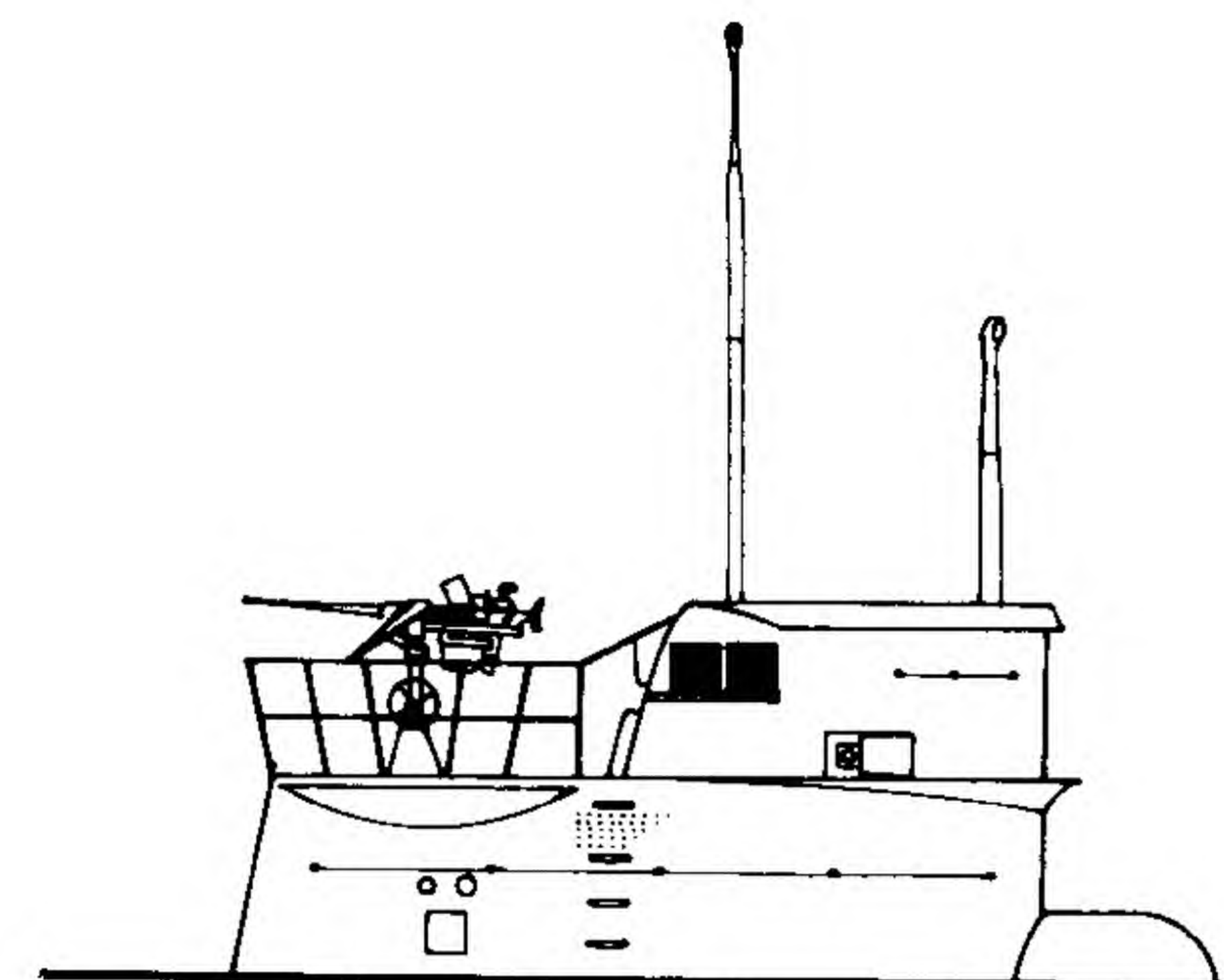
A12/9 U-FLAK 1 MODIFICATION (*U441*, Type VIIC, 1943)

- 1 3.7cm SKC30U FlaK cannon on LC 39 mounting
- 2 After quadruple 2cm L38/43 U FlaK cannon and shield
- 3 Armoured bridge (splinter-proof)
- 4 Forward bridge extension
- 5 Forward quadruple 2cm FlaK

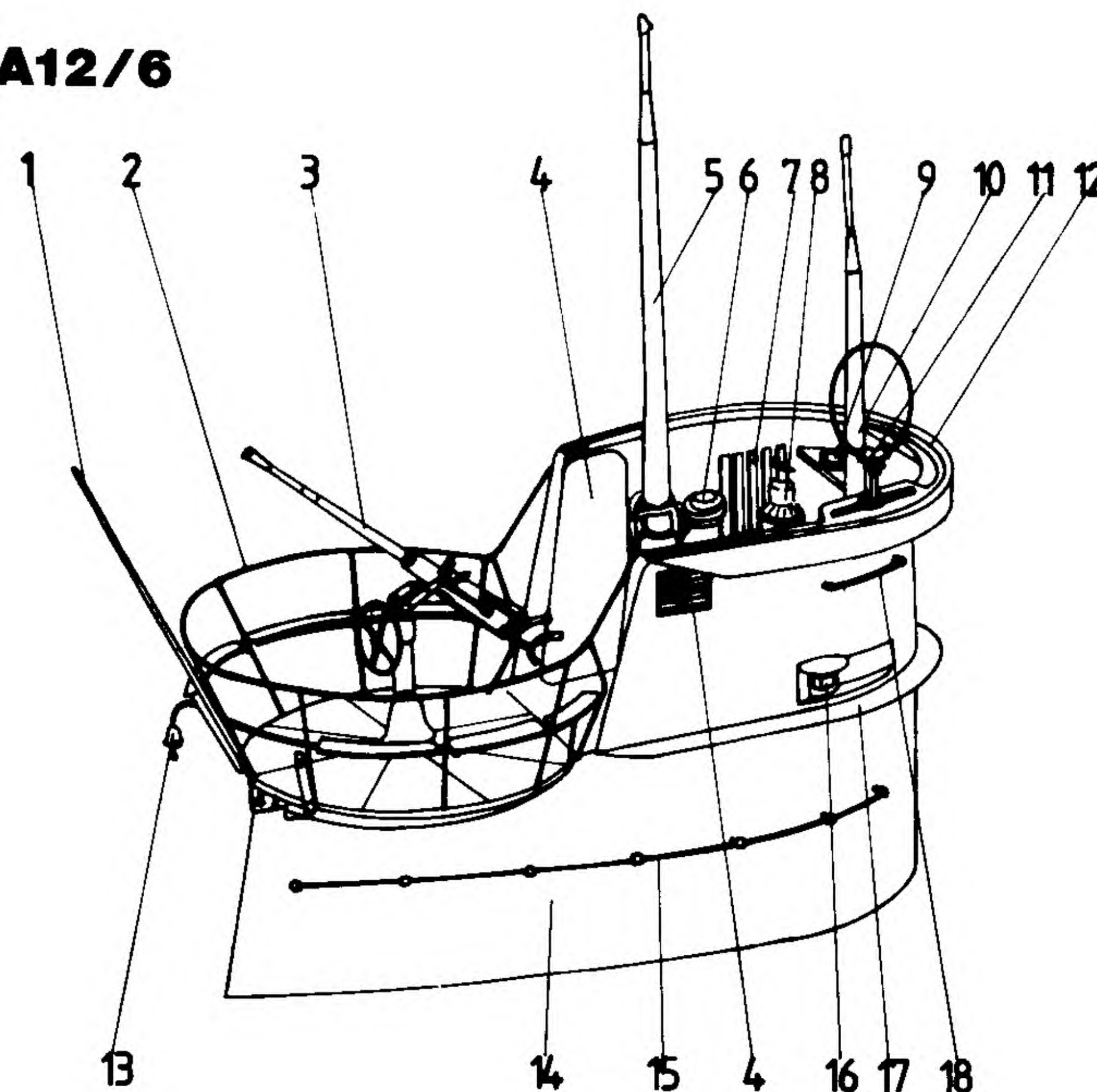
A12/10 MODIFICATION II (Type VIIC, 1943)

- 1 2cm C38 FlaK cannon on LC 30/37 mounting
- 2 Armoured bridge casing (splinter-proof)
- 3 Aerial for FuMO 29 radar
- 4 Access ladder to lower gun platform
- 5 Outer casing deck
- 6 Upper gun platform support
- 7 Drainage holes (bridge and upper gun platform)
- 8 Navigation light, starboard (armoured)

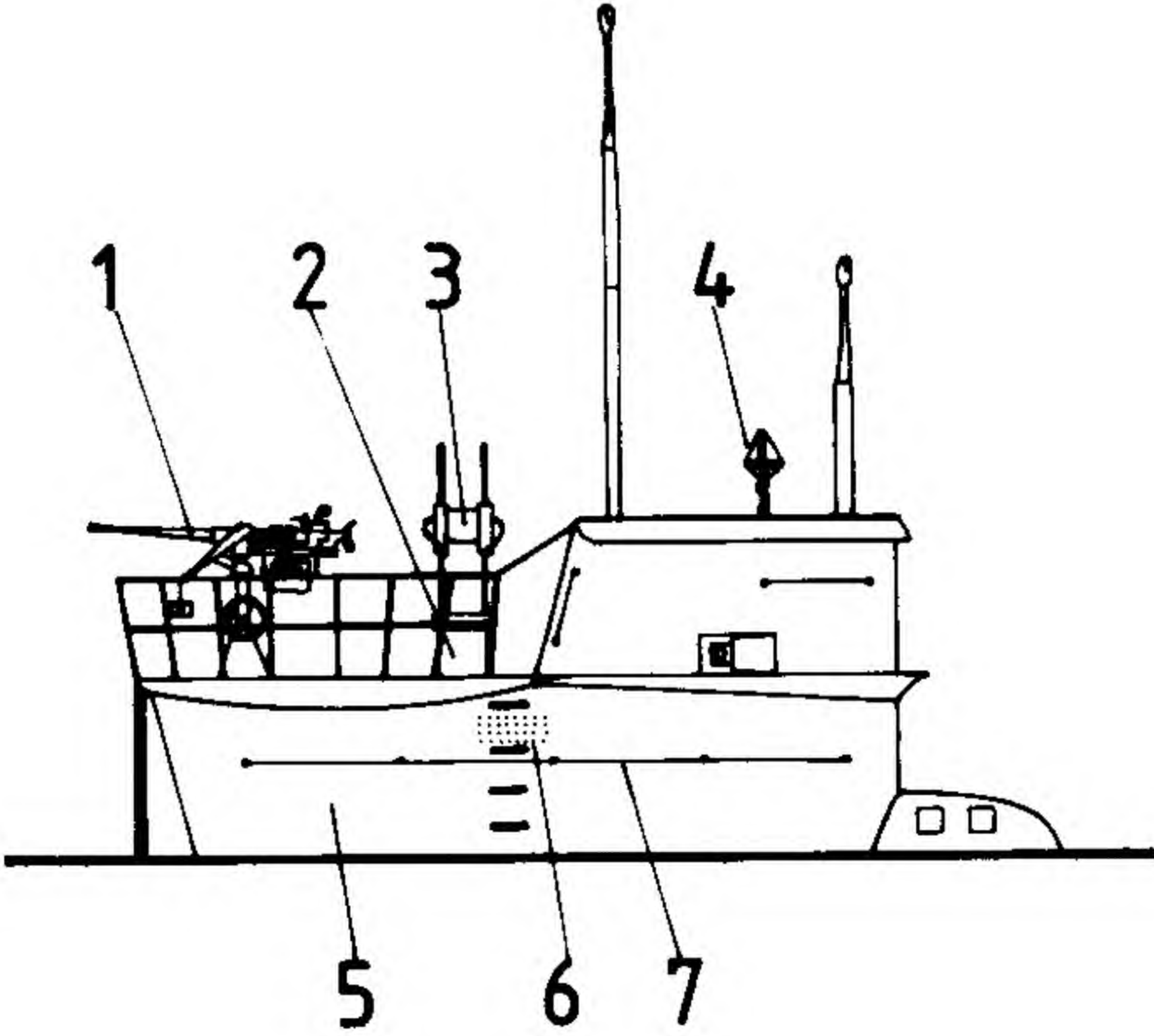
A12/5



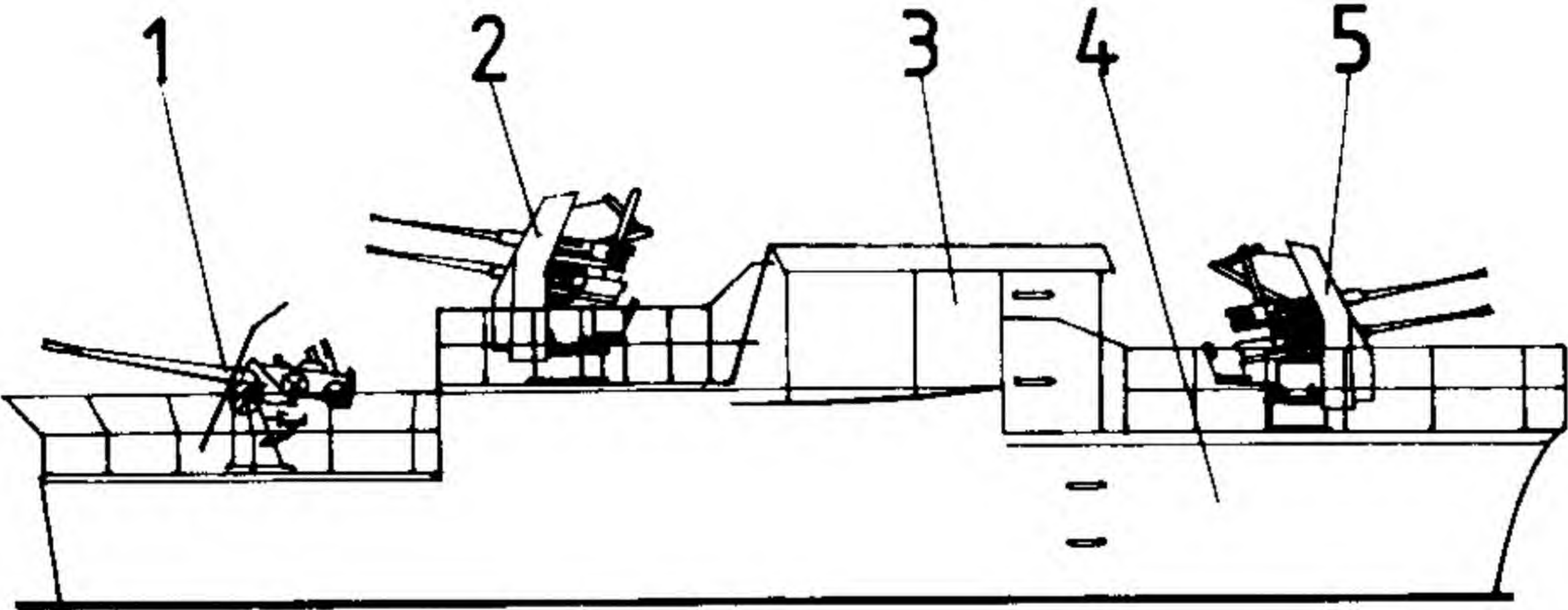
A12/6



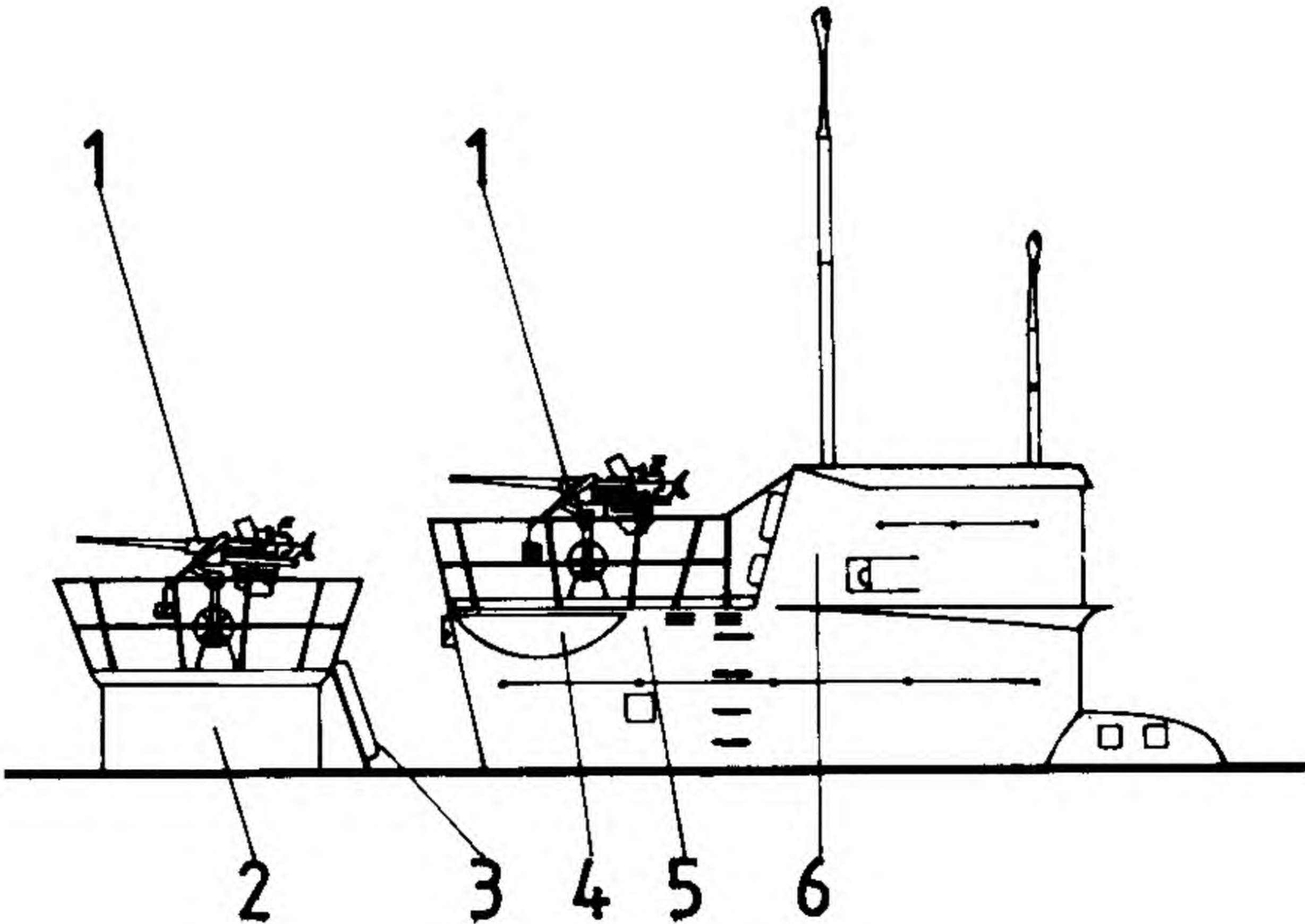
A12/7



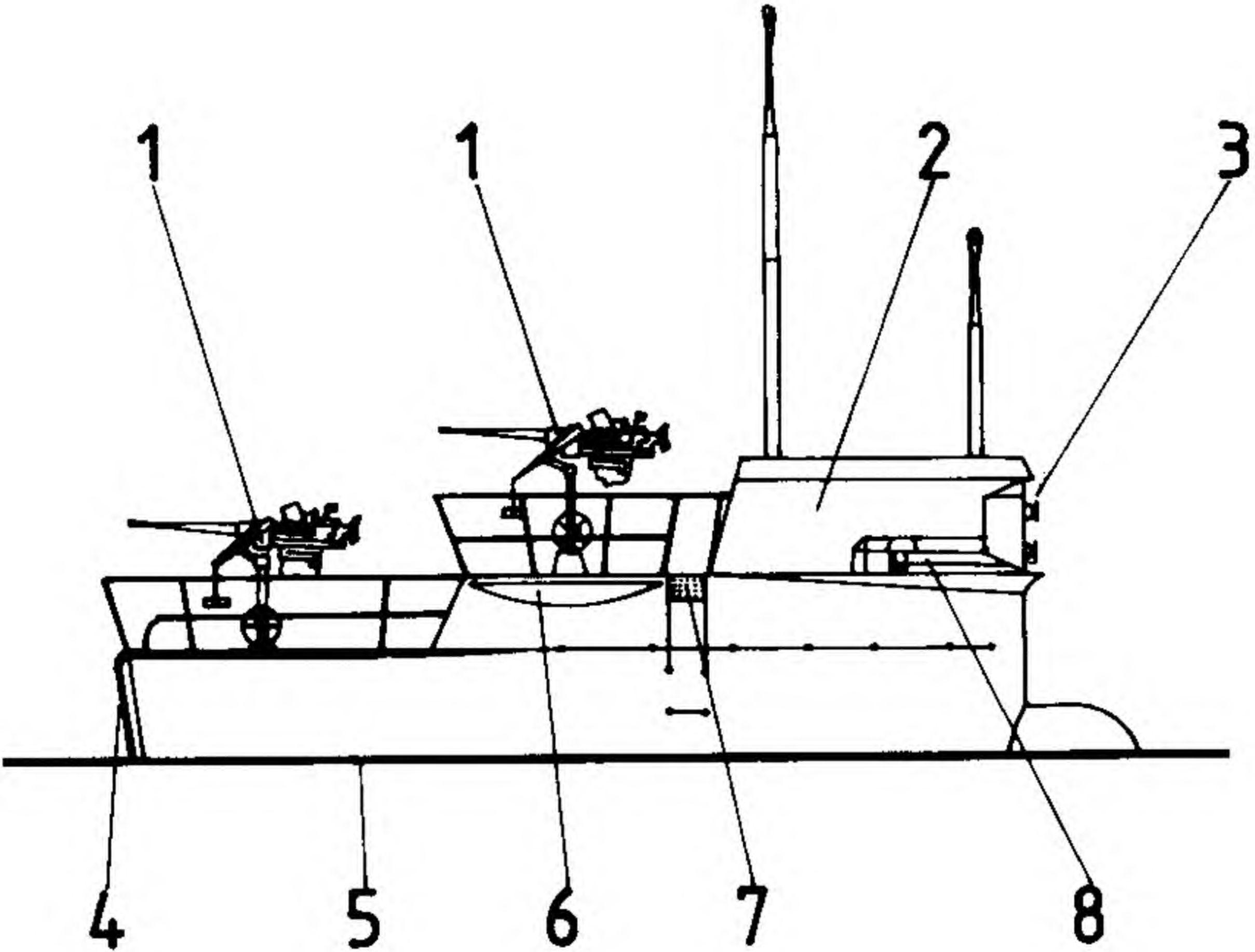
A12/9



A12/8



A12/10



A General arrangement – external

A12/11 TYPE VIIC (1944–45)

- 1 3.7cm watertight ready-use ammunition container
- 2 3.7cm SKC30U on LC 39 mounting
- 3 2cm watertight ready-use ammunition container
- 4 2cm C38 twin LM 43 U FlaK cannon and shield (port and starboard)
- 5 Main 2cm watertight ready-use ammunition container
- 6 Aerial for FuMO 61 and DF set
- 7 Attack periscope
- 8 Aerial for FuMB 26
- 9 Air search periscope
- 10 Armoured bridge casing (splinter-proof)
- 11 Outer casing deck
- 12 Access ladder to lower gun platform
- 13 Fixed guard rails
- 14 Hand rail
- 15 Upper gun platform support
- 16 Drainage holes (bridge and upper gun platform)
- 17 Improved wave deflector

A12/12 TYPE VIIC/41 (general view with Schnorchel raised and lower 'Wintergarten'; no scale)

- 1 Main magnetic compass
- 2 Control room periscope
- 3 DF aerial
- 4 Attack periscope
- 5 'Bali' aerial (FuMB 29)
- 6 Air inlet trunking
- 7 2cm ready-use ammunition container
- 8 Two 2cm FlaK
- 9 Upper 'Wintergarten'
- 10 Safety rail (to prevent guns firing at dangerous angles)
- 11 3.7cm automatic FlaK
- 12 Schnorchel housing
- 13 Schnorchel piston
- 14 Schnorchel (with a second 'Bali' aerial at its head)
- 15 Housing and aerial of radar equipment
- 16 Access steps
- 17 Lower 'Wintergarten'
- 18 5 man life raft container

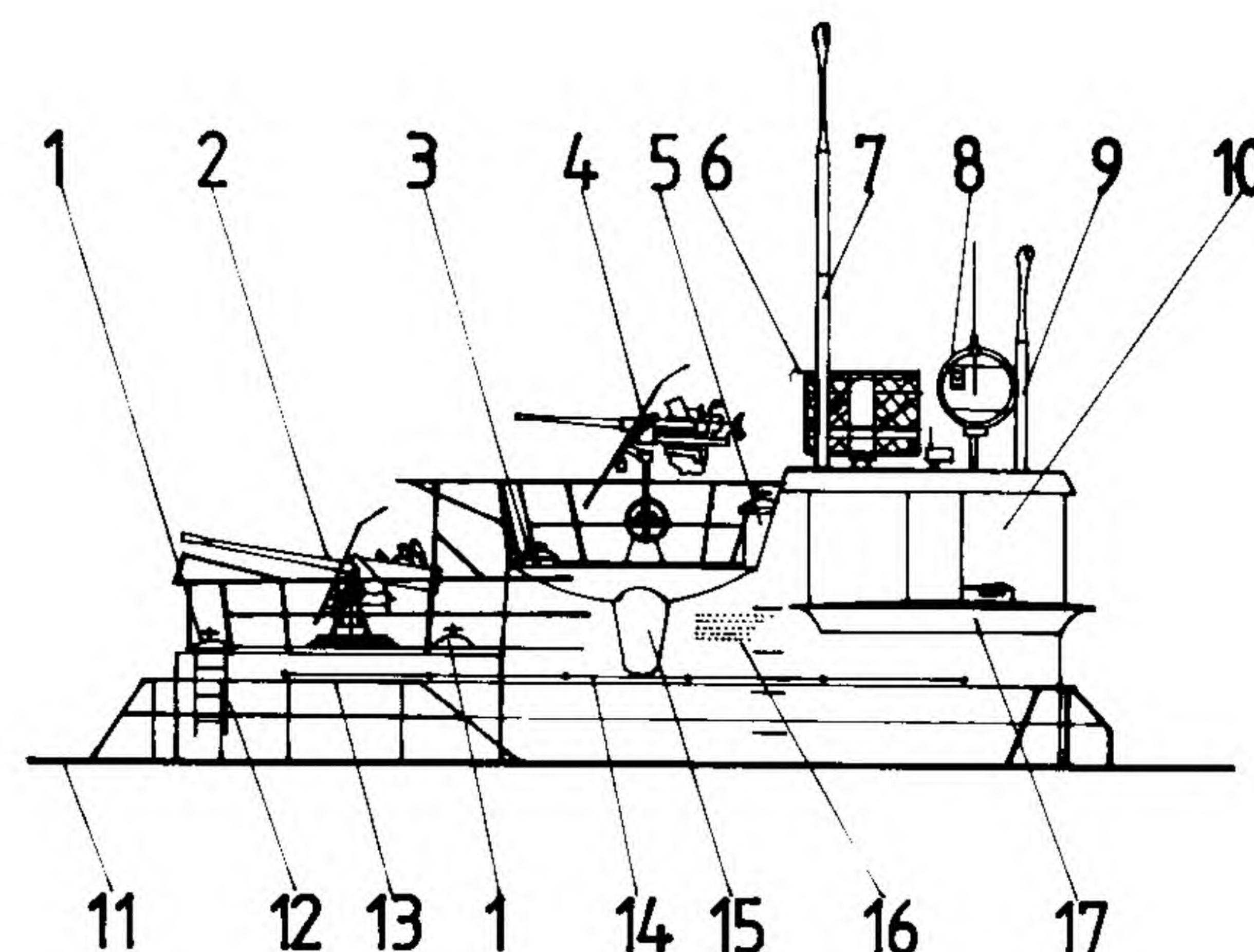
A12/13 TYPE VIIC/41 (U 995, elevation)

- 1 3.7cm FlaK
- 2 Position of gun shield when folded forward
- 3 Gun shield
- 4 Gun cradle
- 5 Feed guides for 5-round ammunition clips
- 6 Twin 2cm FlaK (port and starboard)
- 7 Gun shield
- 8 Upper 'Wintergarten' safety railings
- 9 Line of conning tower
- 10 Ventilator
- 11 Attack periscope self-greasing liner
- 12 UZO binoculars
- 13 Control room/air search periscope and self-greasing liner
- 14 Stern navigation light
- 15 Ready-use ammunition container (watertight) for 3.7cm ammunition
- 16 Lower 'Wintergarten'
- 17 Training pedestal for 3.7cm FlaK
- 18 3.7cm FlaK base
- 19 Gunlayer's seat
- 20 Training wheel
- 21 Safety rail
- 22 2cm ready-use ammunition container (watertight)
- 23 Upper 'Wintergarten' support
- 24 2cm FlaK pedestal
- 25 Immediate-use 2cm ammunition container (watertight)
- 26 Attack periscope
- 27 Outer casing
- 28 UZO pedestal and computer transmitter
- 29 Control room/air search periscope
- 30 Forward line of conning tower casing

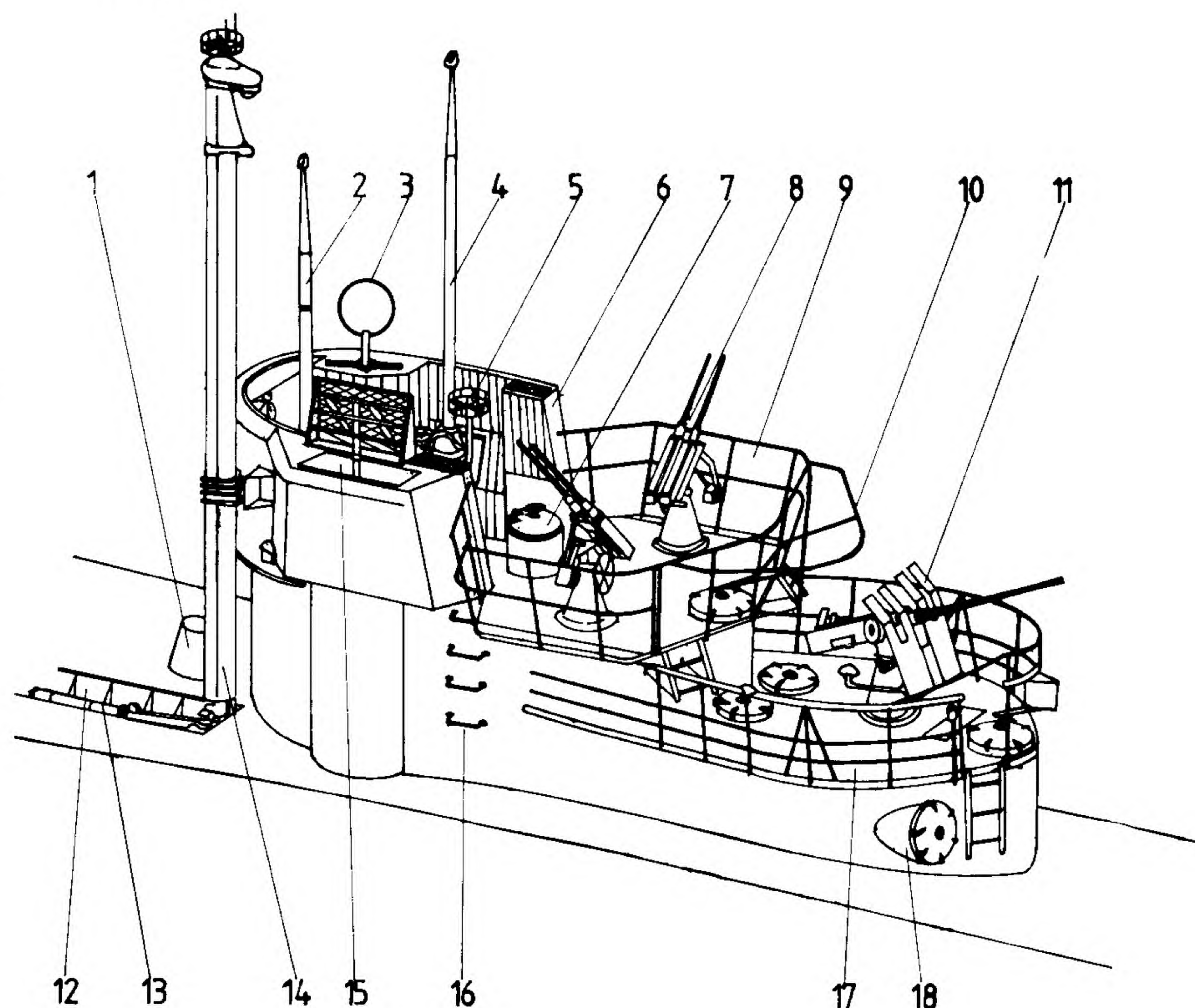
A12/14 TYPE VIIC/41 (U 995, forward elevation, showing the asymmetrical aspect of the conning tower in the latter years of the war)

- 1 Upper wave deflector
- 2 Upper 'Wintergarten' safety railing
- 3 Schnorchel locking housing and air input trunking port
- 4 Starboard navigation light
- 5 Lower 'Wintergarten' and safety railing
- 6 Main magnetic compass housing
- 7 Low pressure air outlet piping to Schnorchel

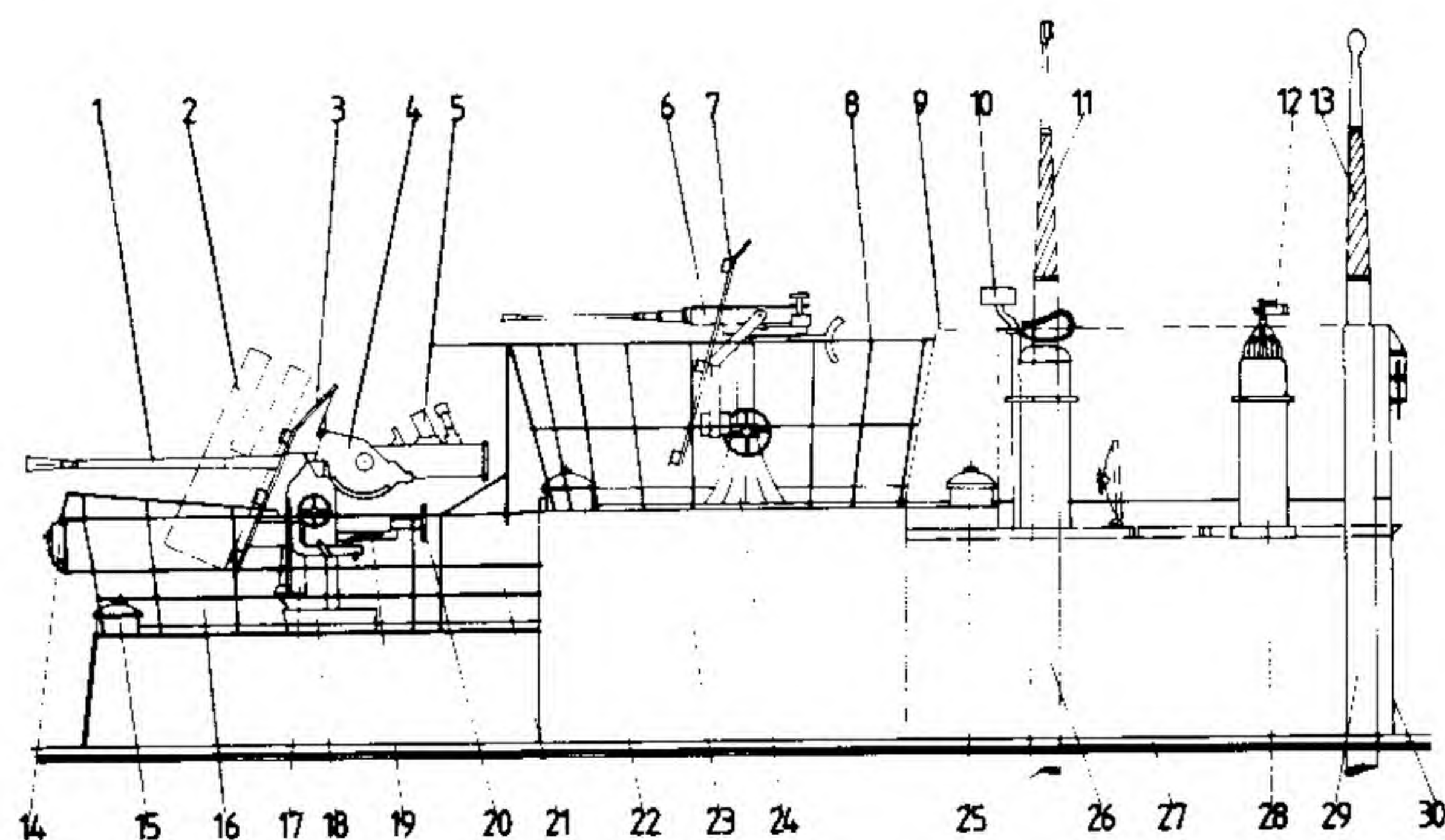
A12/11



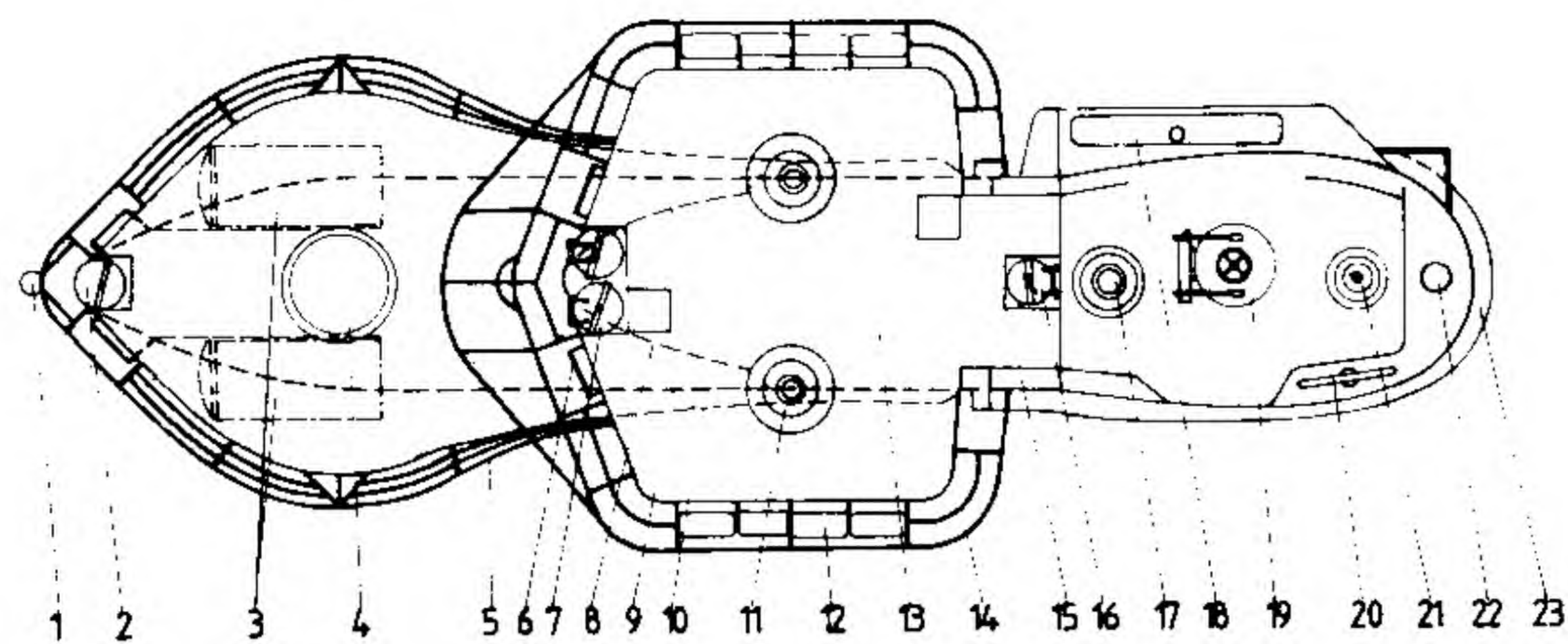
A12/12



A12/13

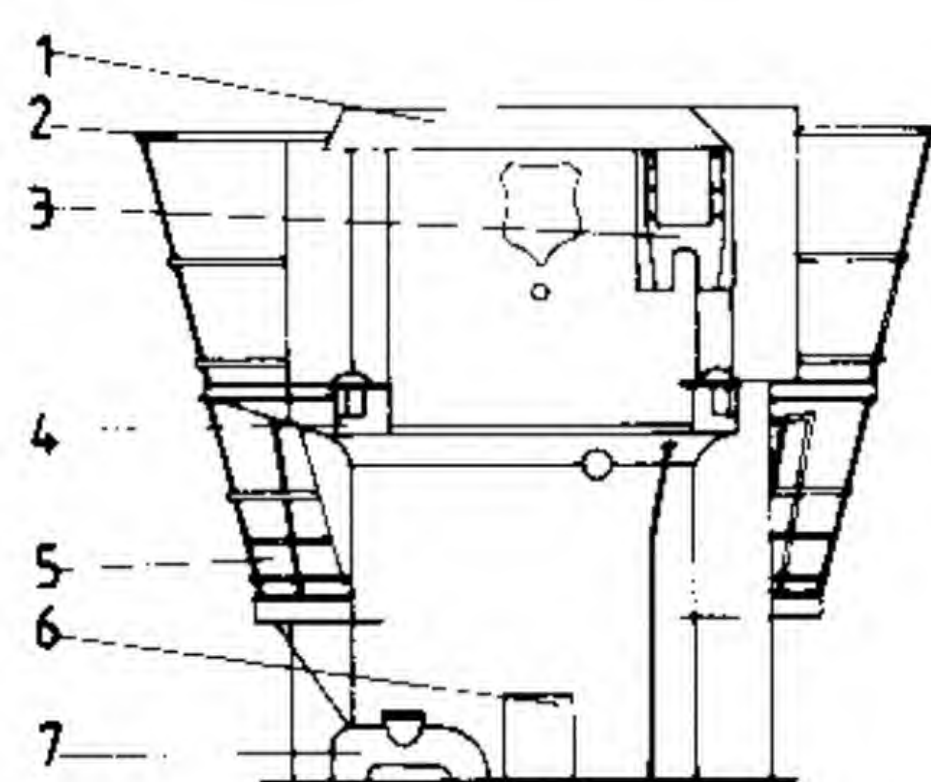


A12/15

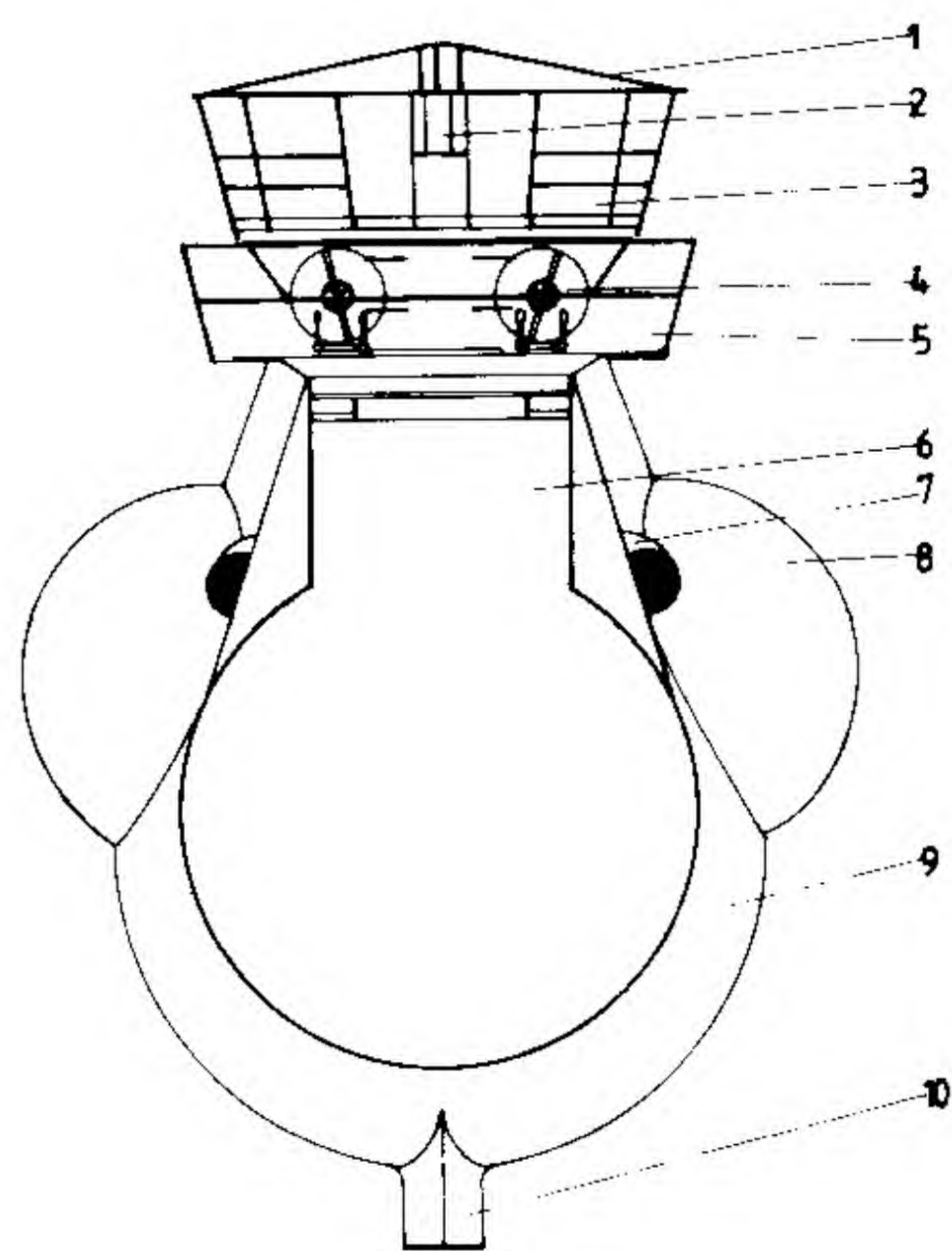


- A12/15 TYPE VIIC/41 (U 995, plan view)**
- 1 Stern navigation light
 - 2 Ready-use ammunition container (watertight) for 3.7cm
 - 3 Watertight container for 5 man raft
 - 4 3.7cm gun mounting pedestal
 - 5 Lower 'Wintergarten' railing
 - 6 Access ladder to upper 'Wintergarten'
 - 7 Ready-use ammunition container (two) for 2cm weapons
 - 8 Line of upper 'Wintergarten' railing
 - 9 General outline of extended bridge
 - 10 Outline of railing extension for lower 'Wintergarten'
 - 11 Mounting for two 2cm mountings
 - 12 Seats for crew
 - 13 Upper 'Wintergarten' deck
 - 14 Upper 'Wintergarten' safety railing
 - 15 Air inlet (port and starboard) for diesel air intakes
 - 16 Ready-use ammunition locker (first use) for 2cm weapons
 - 17 Attack periscope sleeve
 - 18 Housing for radar aerials
 - 19 Attack tower access/escape hatch
 - 20 DF aerial and housing
 - 21 UZO mounting and sleeve
 - 22 Control room periscope sleeve and housing
 - 23 Forward (upper) wave deflector

A12/14



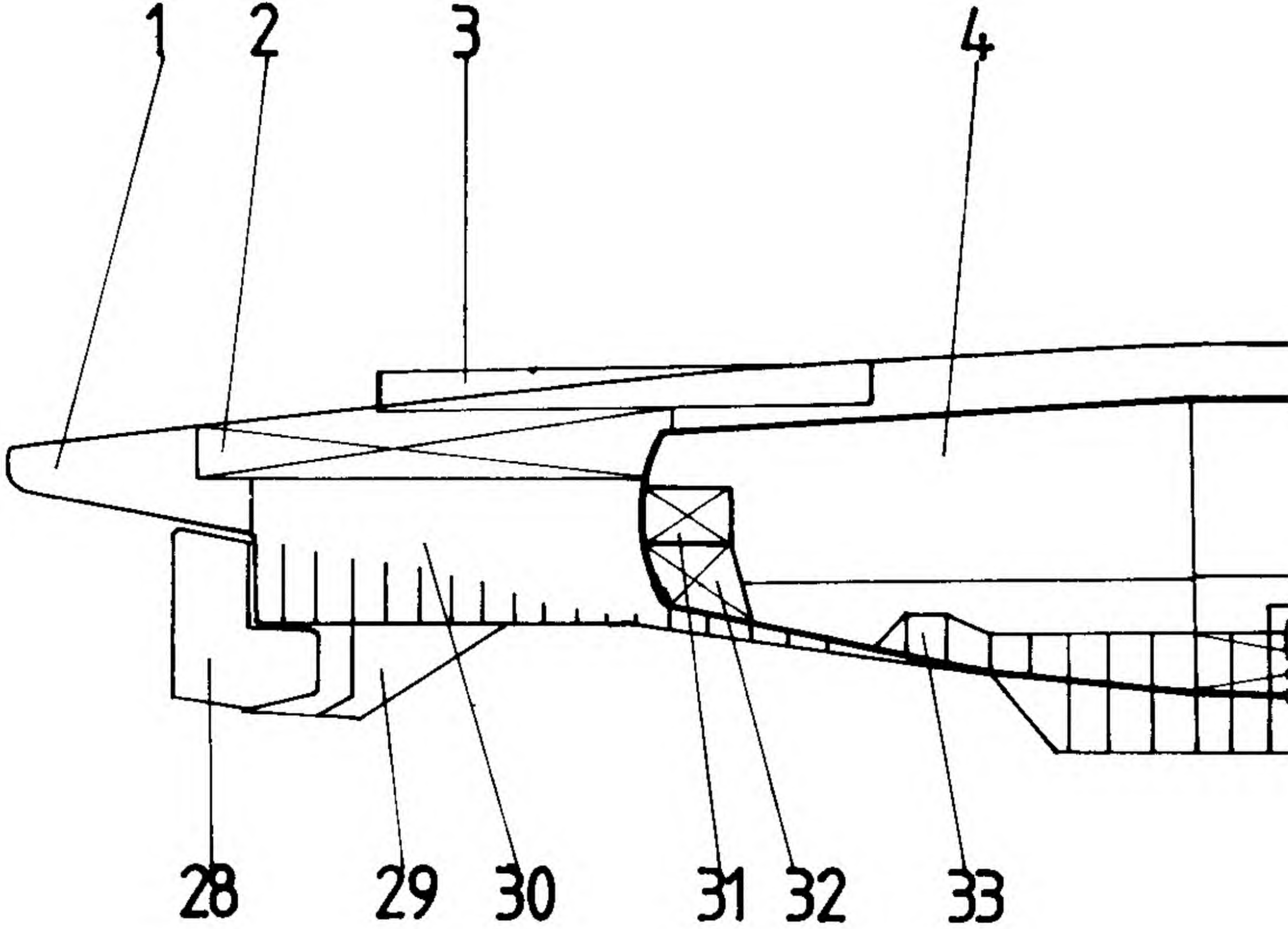
A12/16



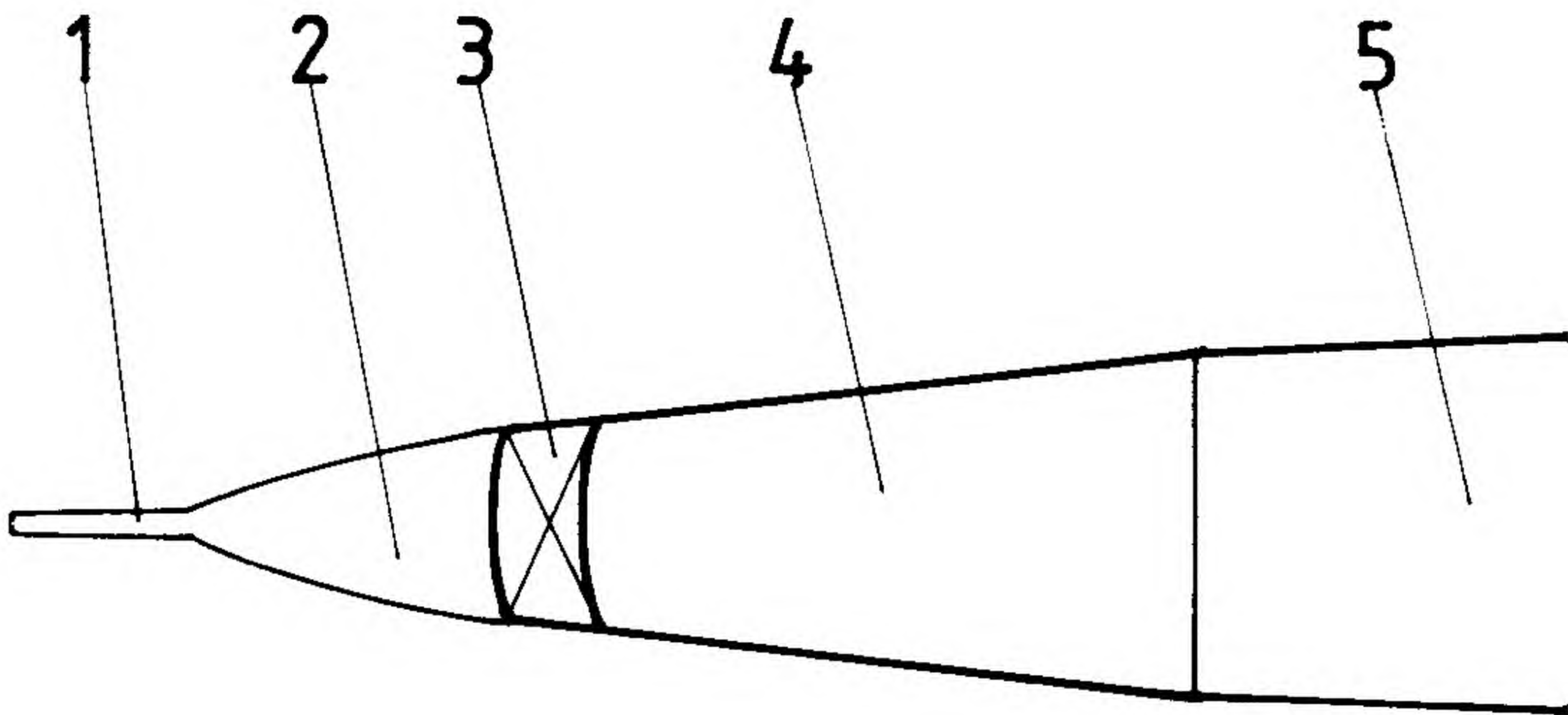
- A12/16 TYPE VIIC/41 (U 995, view from aft)**
- 1 Safety rail of upper 'Wintergarten'
 - 2 Attack periscope
 - 3 Upper 'Wintergarten'
 - 4 5 man life raft containers (watertight)
 - 5 Lower 'Wintergarten'
 - 6 Lower 'Wintergarten' support
 - 7 Starboard diesel exhaust
 - 8 Starboard saddle tank
 - 9 Outer casing line abaft the tower
 - 10 Keel

B General arrangements – internal

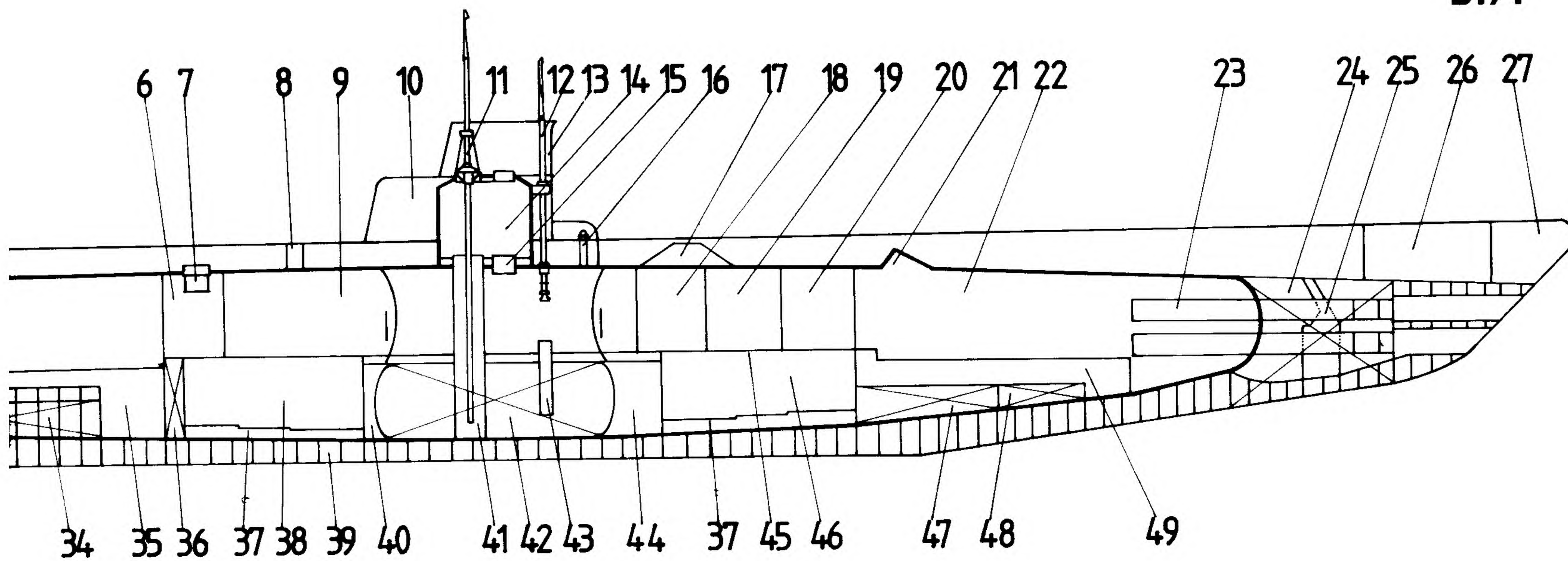
B1/1 INTERNAL PROFILE, TYPE VII		24	Bow diving tank
1	Stern casing	25	Anchor chain locker (free-flooding)
2	Stern diving tank	26	Watertight bow section
3	Stern external torpedo tube (I)	27	Bow casing
4	Electric motor room	28	Single rudder
5	Diesel engine compartment	29	Rudder and hydroplane support beam
6	Galley	30	Free-flooding after casing
7	Galley access/escape hatch (watertight)	31	Torpedo compensating tank, aft torpedo tube
8	Hardened pedestal for 2cm FlaK mounting	32	Aft trim tank
9	Senior rates' mess	33	Electric motor mounting
10	Aft casing of tower	34	Diesel engine mounting
11	Attack periscope and sheath	35	Lower engine room space
12	Control room periscope	36	Fresh water tank
13	Bridge casing	37	Battery compartment floor mounting
14	Attack centre	38	Battery room I
15	Access hatch between attack centre and control room (with bridge watertight hatch above)	39	Keel
16	Main magnetic compass and housing	40	Fuel oil tank
17	Hardened pedestal for 8.8cm main deck gun mounting	41	Attack periscope sleeve
18	Captain's cabin	42	Main diving tank
19	Officers' quarters and wardroom	43	Control room periscope sleeve
20	Chief rates' mess	44	Fuel oil tank
21	Forward torpedo loading hatch	45	Internal deck plating
22	Forward torpedo room and ratings' quarters	46	Battery room II
23	Torpedo tube II (one of four)	47	Forward torpedo compensating tank (port and starboard, each serving two tubes)
		48	Forward trim tank
		49	Reserve torpedo storage space



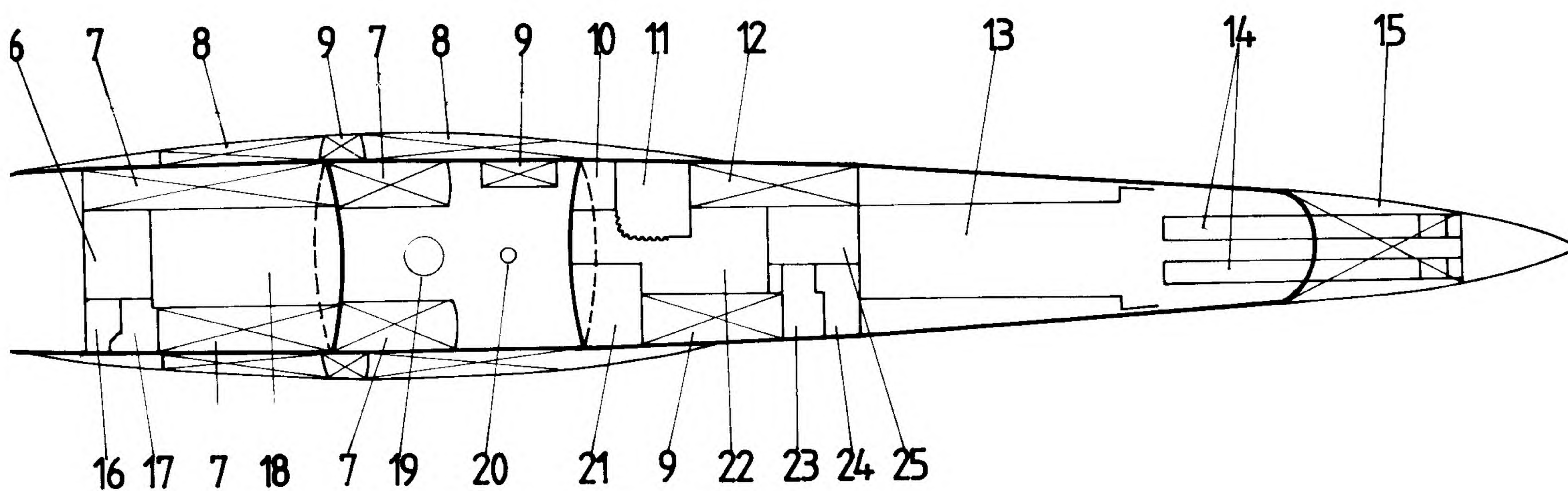
B1/2 INTERNAL PLAN VIEW, TYPE VII		11	Captain's cabin
1	Stern hydroplane and rudder support beam	12	Fuel oil tank
2	Free-flooding after casing	13	Forward torpedo room and ratings' quarters
3	Aft torpedo tube compensating tank	14	Bow torpedo tubes (number I to starboard, number II to port)
4	Motor room	15	Bow diving tank
5	Engine room	16	After battery automatic switching room
6	Galley	17	'Heads' (lavatories)
7	Fuel oil tank	18	Senior rates' quarters and mess
8	Saddle-tank ballast cell (port and starboard)	19	Attack periscope sleeve
9	Fuel/water compensation tank (port and starboard)	20	Control room periscope sleeve
9a	Fresh water tank (linked to control system of 9)	21	Radio room
10	Forward battery automatic switching room	22	Wardroom
		23	Food store
		24	Heads and washroom
		25	Chief rates' mess and quarters



B1/1



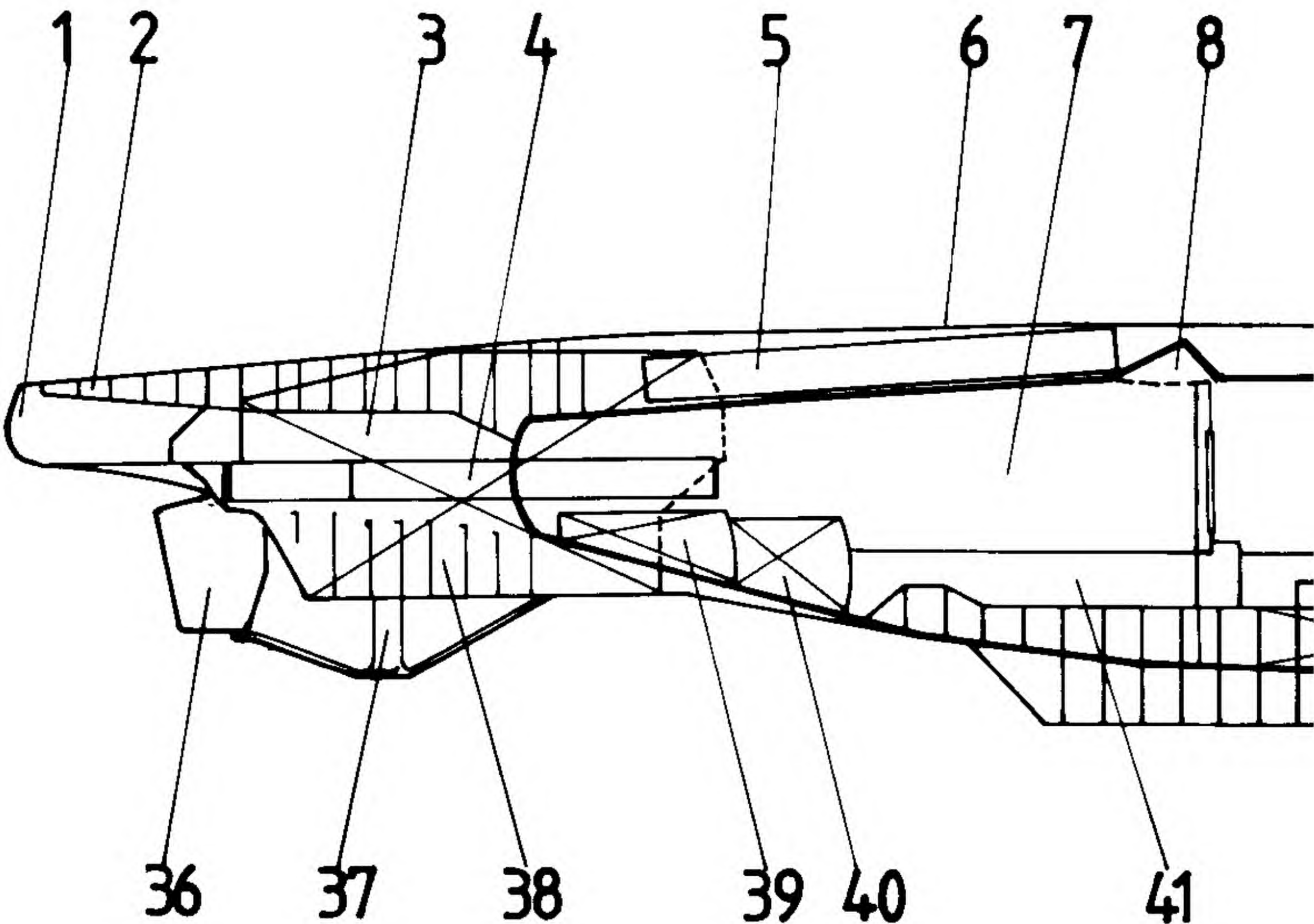
B1/2



B General arrangements – internal

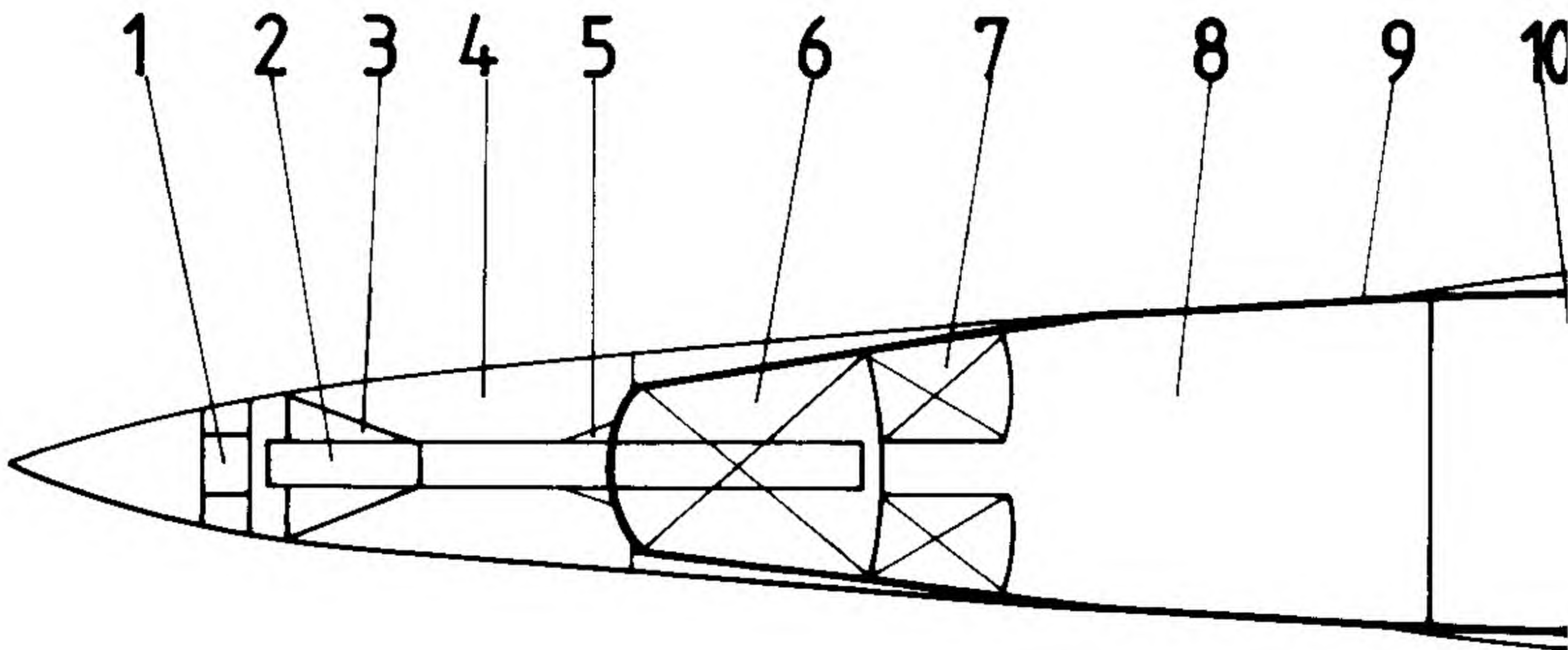
B2/1 INTERNAL PROFILE, TYPE VIIIB

1	Stern casing	29	Forward reserve torpedo container
2	Deck casing knee beam	30	Forward torpedo room and rates' quarters
3	Stern diving tank	31	Forward 'subsunk' marker buoy
4	Stern (internal) torpedo tube	32	Torpedo tube II
5	External reserve torpedo container	33	Watertight bow section
6	Upper deck	34	Tow hook housing
7	Motor room	35	Bow casing
8	Stern torpedo loading hatch	36	Starboard rudder
9	Engine room	37	Support beam
10	Galley	38	Free-flooding lower after casing
11	Galley access/escape hatch	39	Aft trim tank
12	Senior rates' mess and quarters	40	Torpedo compensating tank
13	2cm FlaK pedestal	41	Lower motor room space
14	'Subsunk' marker buoy	42	Engine mountings
15	Attack centre	43	Battery room I
16	Attack periscope	44	Fuel oil tank
17	Tower/bridge access/escape hatch (watertight)	45	Main diving tank
18	Control room periscope	46	Magazine
19	Bridge casing	47	S- <i>Gerät</i> (sound detection equipment) compartment
20	Main magnetic compass and housing	48	Battery room II
21	Control room	49	Torpedo compensating tanks (port and starboard) for tubes I-IV
22	8.8cm main deck gun pedestal	50	Forward trim tank
23	Captain's cabin	51	Reserve torpedo storage space (4 torpedoes)
24	Officers' quarters and wardroom	52	Anchor chain locker (free-flooding)
25	Watertight ready-use ammunition container (8.8cm ammunition)	53	Torpedo tubes forward caps
26	Chief rates' mess and quarters	54	Strengthened bow plate
27	Heads and washroom		
28	Forward watertight torpedo loading hatch		

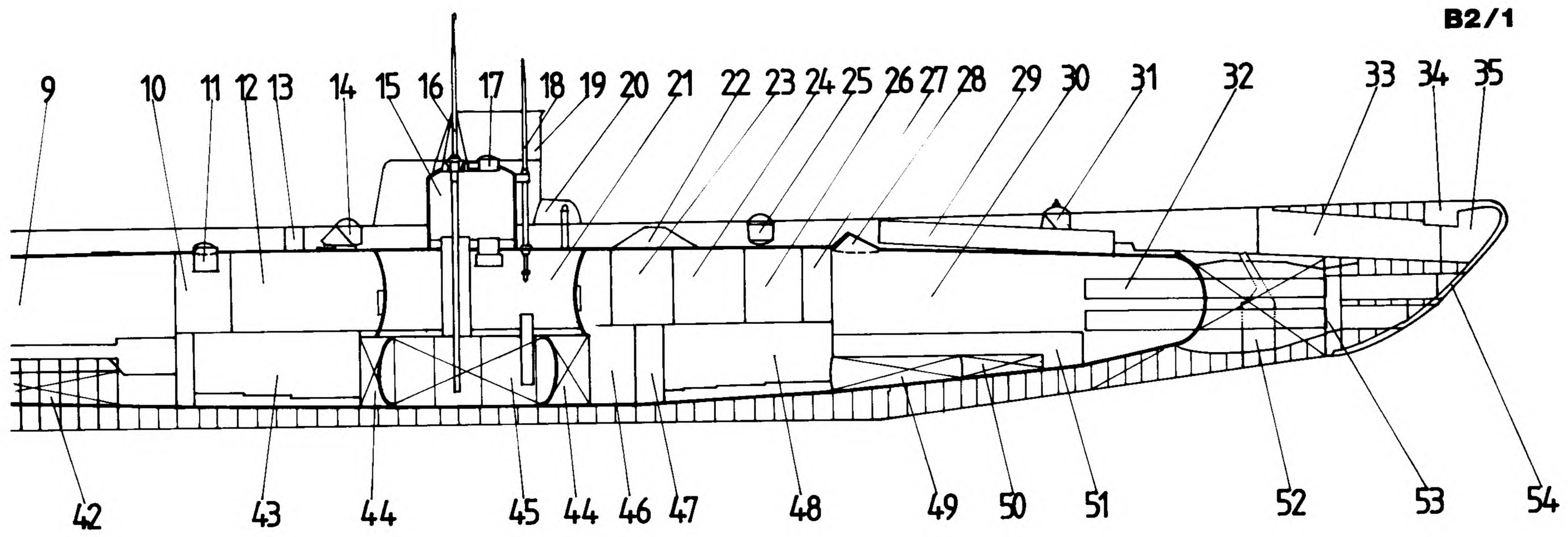


B2/2 INTERNAL PLAN VIEW, TYPE VIIIB

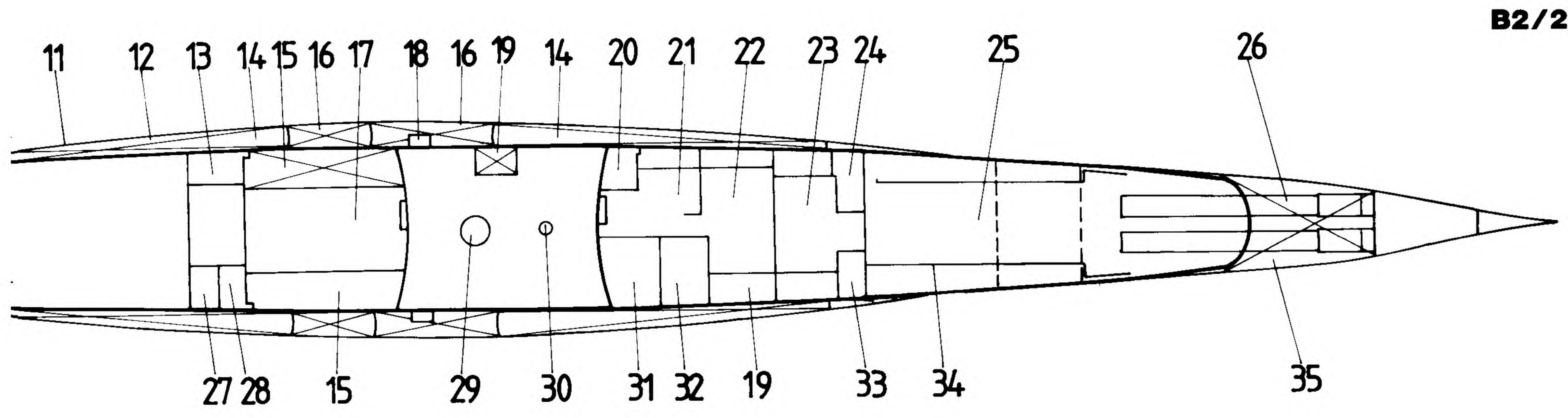
1	Aft spacer and aperture for torpedo firing	19	Fresh water tank
2	Aft internal torpedo tube	20	Forward automatic battery switching room
3	Torpedo tube support	21	Captain's cabin
4	Stern diving tank	22	Wardroom and officers' quarters
5	Mounting of torpedo tube on pressure hull	23	Chief rates' quarters and mess
6	Aft trim tank	24	Heads and washroom
7	Torpedo compensating tanks (port and starboard)	25	Forward torpedo compartment and rates' mess
8	Motor room	26	Torpedo tube II
9	Pressure hull	27	Aft automatic battery switching room
10	Engine room	28	Heads
11	Saddle-tank casing	29	Attack periscope sleeve
12	Stringer	30	Control room periscope sleeve
13	Food store	31	Radio room
14	Ballast tank	32	Sound detection room
15	Fuel oil tank	33	Food store
16	Fuel/water compensating tanks	34	Internal bulkhead containing lockers for crew's personal possessions
17	Senior rates' mess and quarters	35	Bow diving tank
18	Air trunk		



B2/1



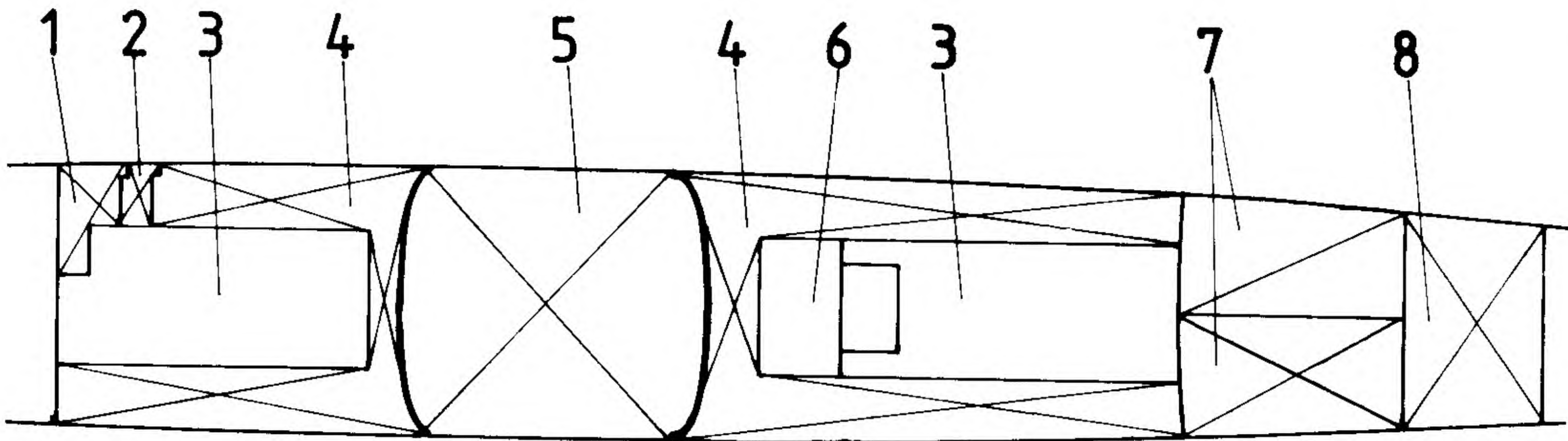
B2/2



B General arrangements – internal

B2/3 INTERNAL PLAN OF HOLD, TYPE VIIB

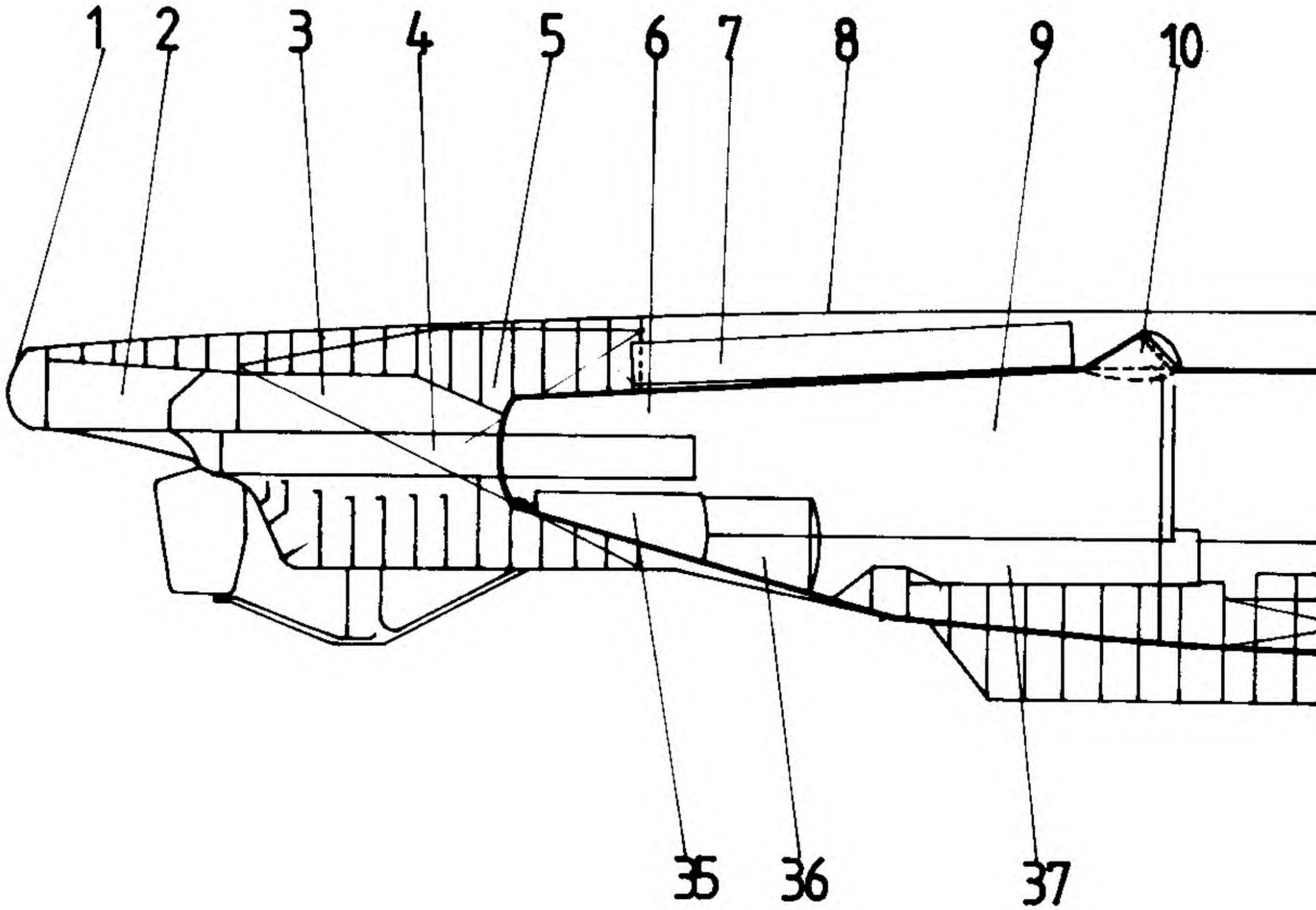
- 1 Fresh water tank
- 2 Dirty water tank
- 3 Battery room I flooring
- 4 Fuel oil tank
- 5 Main diving tank
- 6 Magazine flooring
- 7 Forward torpedo compensating tanks
- 8 Forward trim tank

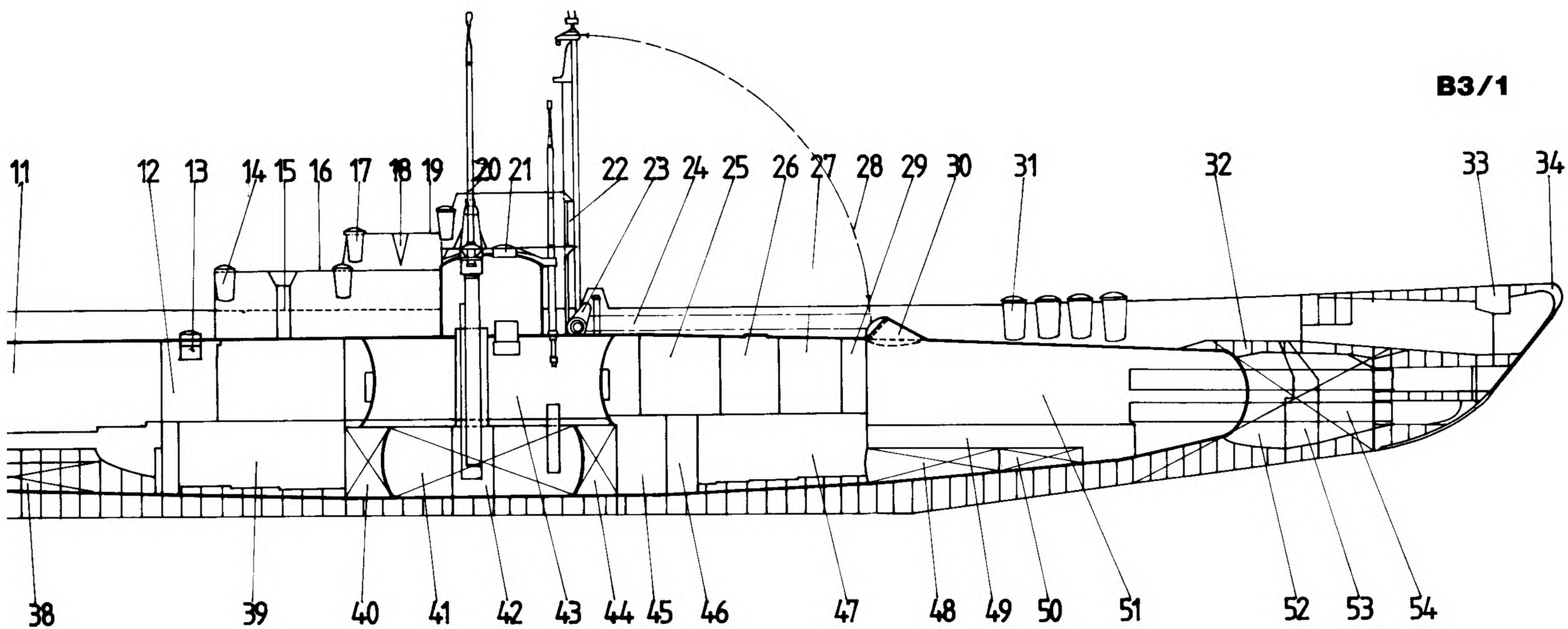


B2/3

B3/1 INTERNAL PROFILE, TYPE VIIC

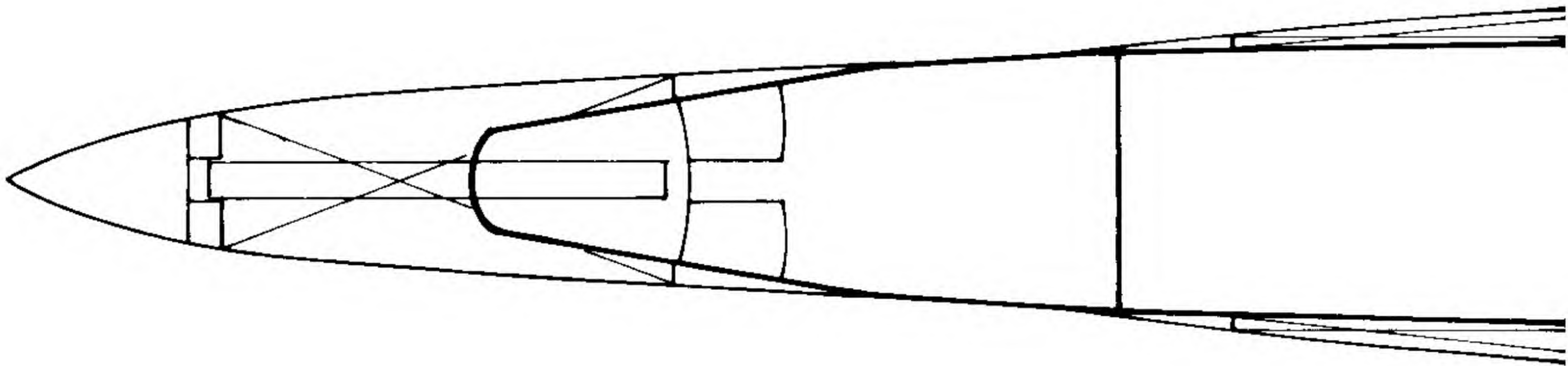
- | | |
|--|---|
| 1 Stern casing | 26 Officers' wardroom |
| 2 Free-flooding stern | 27 Chief rates' quarters |
| 3 Diving tank I | 28 Line of Schnorchel travel |
| 4 Stern torpedo tube | 29 Head |
| 5 Knee beam (supporting stern casing) | 30 Forward torpedo loading hatch |
| 6 Stern torpedo room | 31 5 man life raft containers |
| 7 Reserve torpedo container (watertight) | 32 Forward casing support beam |
| 8 Deck casing | 33 Tow hook housing |
| 9 Motor room | 34 Bow casing |
| 10 Stern torpedo loading hatch | 35 Aft trim tank |
| 11 Diesel room | 36 Torpedo compensating tank |
| 12 Galley | 37 Reserve torpedo stowage (1 torpedo) |
| 13 Galley access/escape hatch | 38 Diesel engine mounting |
| 14 Ready-use ammunition container | 39 Battery room I |
| 15 Lower 'Wintergarten' gun support pedestal | 40 Main diesel fuel tank I |
| 16 Lower 'Wintergarten' | 41 Main diving tank |
| 17 Upper 'Wintergarten' ready-use ammunition container | 42 Attack periscope well |
| 18 Upper 'Wintergarten' gun support pedestal | 43 Control room |
| 19 Upper 'Wintergarten' | 44 Main diesel fuel tank |
| 20 Attack periscope | 45 Magazines |
| 21 Control room/bridge access/escape hatch | 46 S-Gerät compartment |
| 22 Schnorchel tube | 47 Battery room II |
| 23 Schnorchel | 48 Torpedo compensating tank |
| 24 Schnorchel housing | 49 Reserve torpedo stowage |
| 25 Captain's cabin | 50 Forward trim tank |
| | 51 Forward torpedo room and crew's quarters |
| | 52 Diving tank 5 |
| | 53 Anchor well |
| | 54 Torpedo tube III |



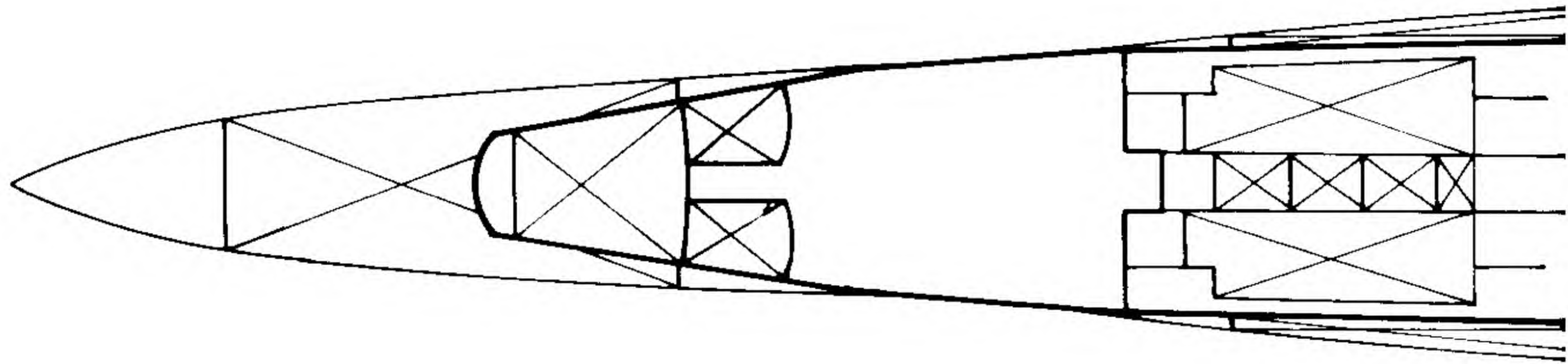


B General arrangements – internal

B3/2 INTERNAL PLAN AT WORKING
DECK LEVEL, TYPE VIIC

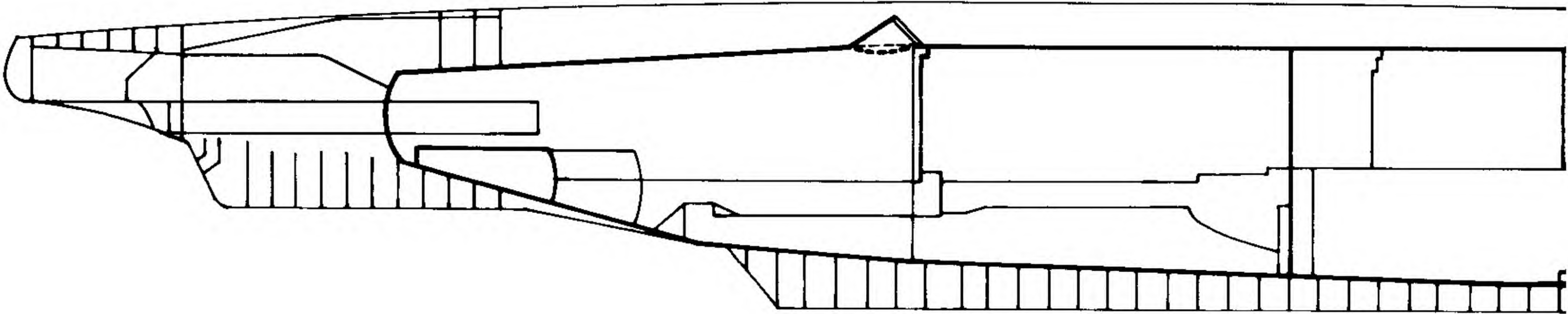


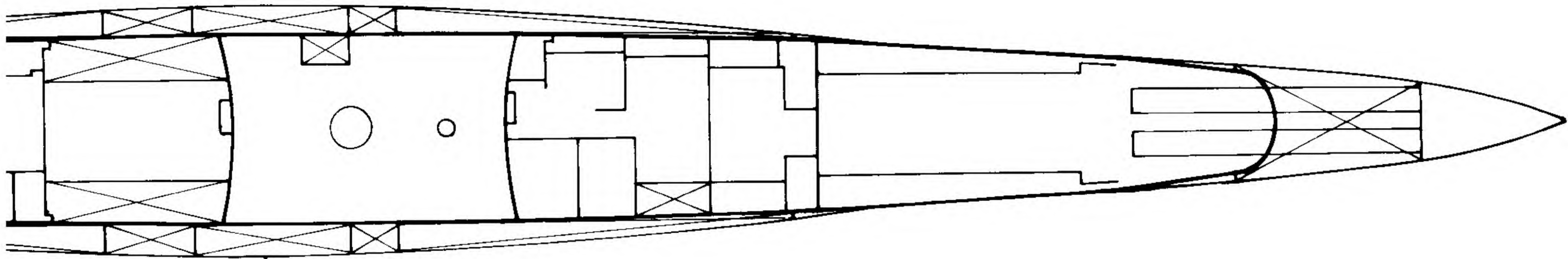
B3/3 INTERNAL PLAN OF HOLD, TYPE
VIIC



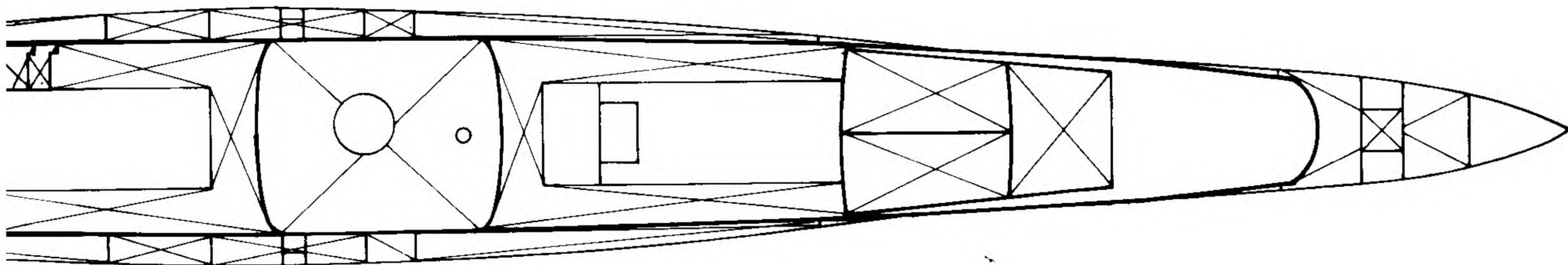
B4/1 INTERNAL PROFILE, TYPE VIID
(with the exception of the inserted
section between Frames 39 and 40
the internal details are as for the
VIIC. Frames within the extension,
as in Drawing B5/1, were lettered A
to N)

- 1 Upper mine shaft closing grating
- 2 Mine shaft number IV (numbered
from forward)
- 3 Casing, mine shaft housing
- 4 Fuel oil tank
- 5 Frame 39
- 6 Lubricating oil tank (starboard)
fresh water tank (port)
- 7 Mine shaft lower reinforcing ring
(shafts were free-flooding)
- 8 Frame 40

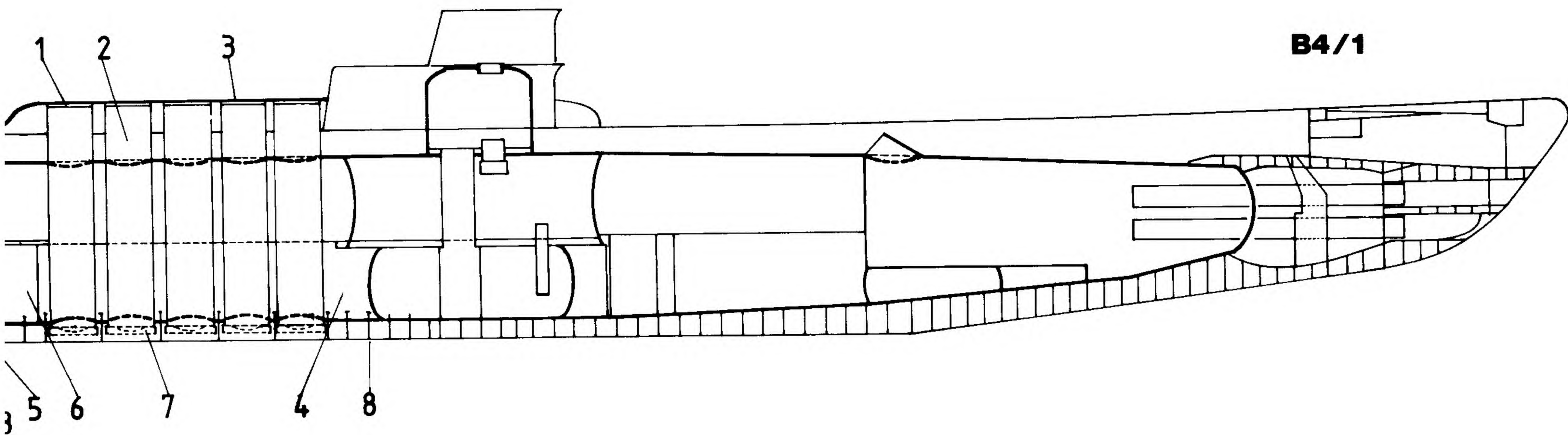




B3/2



B3/3



B4/1

B General arrangements – internal

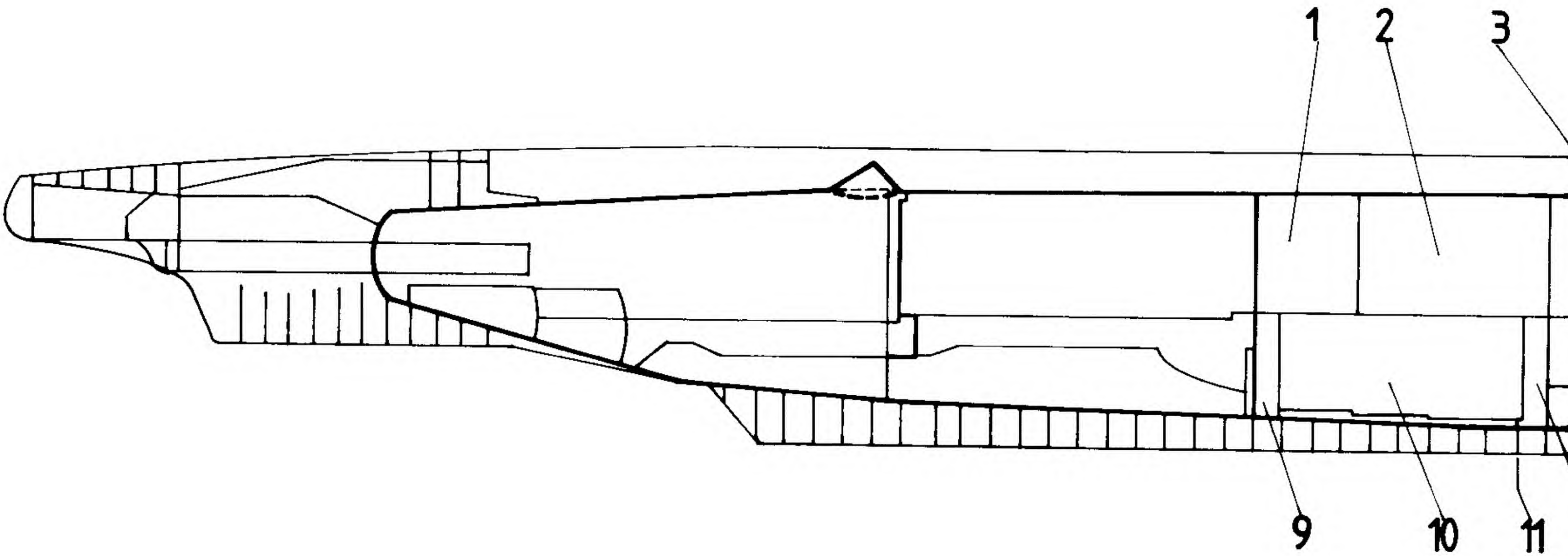
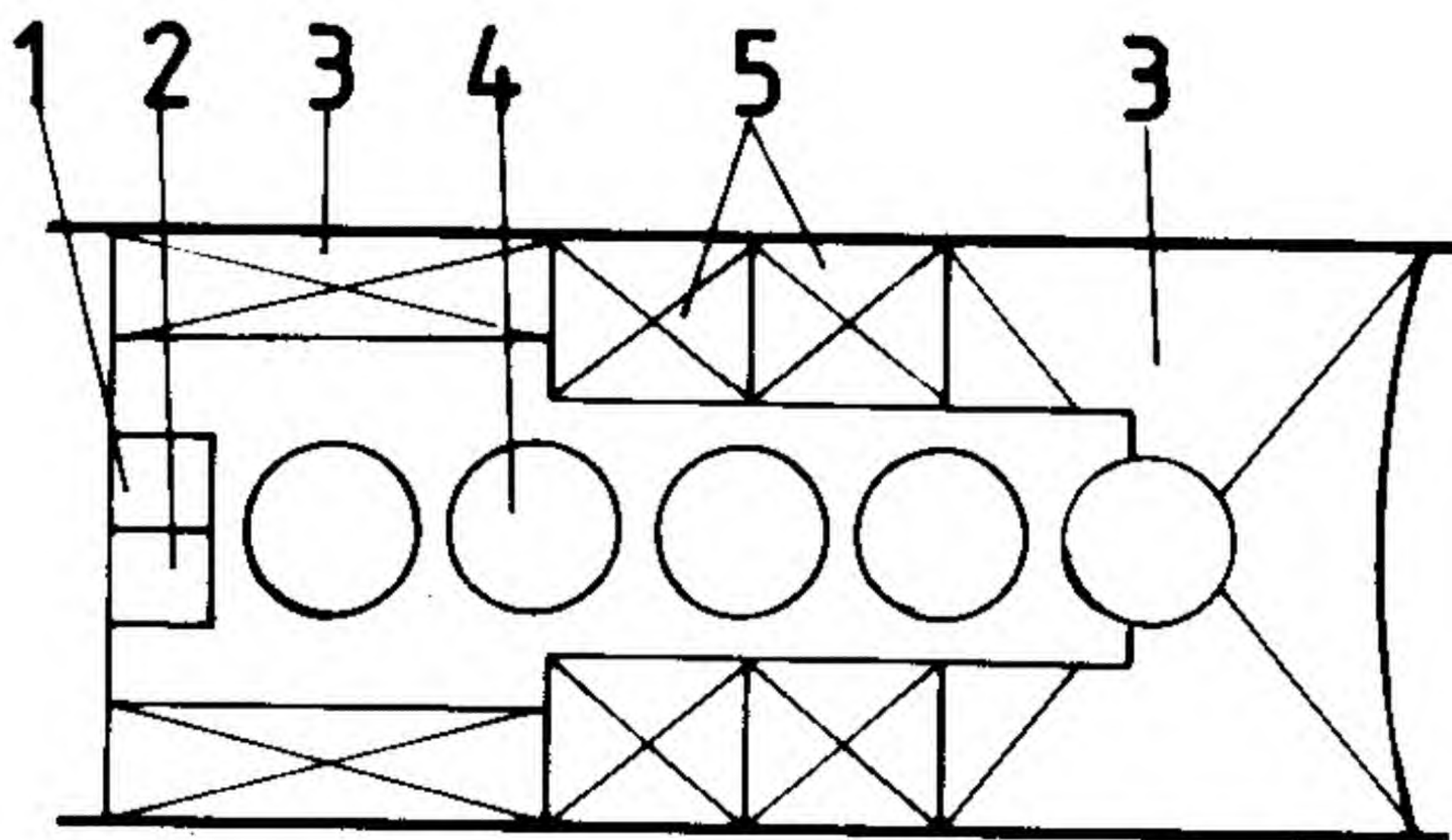
- B4/2 INTERNAL PLAN, PRESSURE HULL DECK LEVEL, TYPE VIID**
- 1 Engine room
 - 2 Fuel oil tank
 - 3 Senior rates' mess
 - 4 Mine compensating tank (6 in all)
 - 5 Ballast tank (water-filled)
 - 6 Ballast tank (initially filled with fuel oil and free-filling with sea water as fuel content diminished)
 - 7 Fuel oil tank
 - 8 Mine compensating tanks (4 in all)
 - 9 Negative buoyancy tank
 - 10 Fuel oil tank
 - 11 Accommodation space
 - 12 Mine release gear
 - 13 Mine shaft I
 - 14 Head
 - 15 Control room
 - 16 Officers' and chief rates' quarters

- B4/3 INTERNAL PLAN AT LEVEL OF KEEL PLATING, TYPE VIID**
- 1 Fresh water tank
 - 2 Lubricating oil tank
 - 3 Fuel oil tank
 - 4 Mine shaft IV
 - 5 Mine compensating tanks

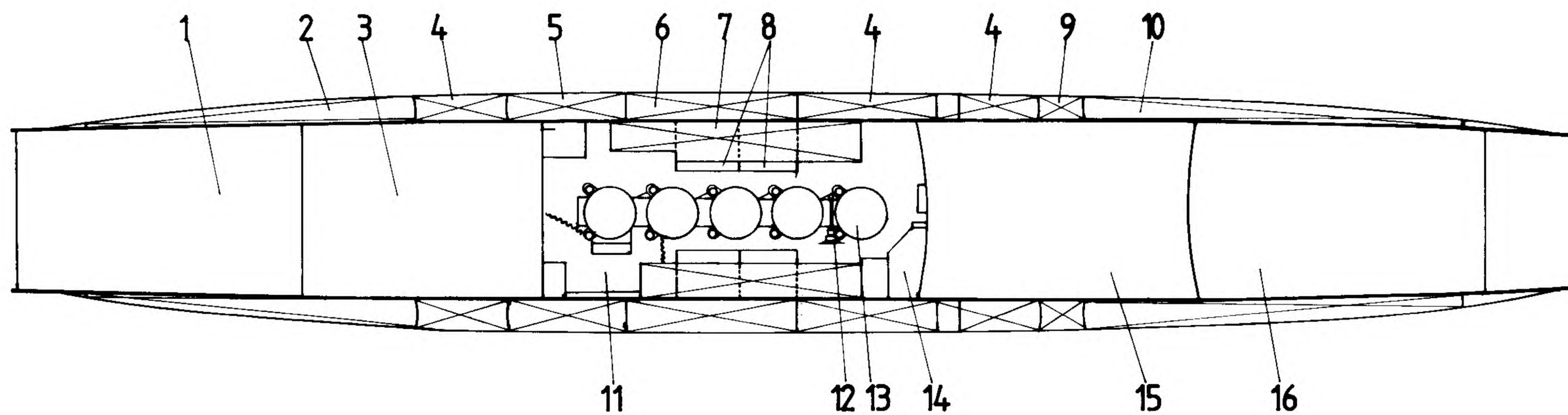
- B5/1 INTERNAL PROFILE, TYPE VIIF (the note to Drawing B4/1 also applies to this drawing)**
- 1 Galley
 - 2 Senior rates' mess
 - 3 Midships torpedo loading hatch
 - 4 Torpedo stowage
 - 5 Reserve torpedo container (port and starboard)
 - 6 Potato store
 - 7 Senior rates' number II mess
 - 8 Heads
 - 9 Fuel oil tank
 - 10 Battery room I
 - 11 Frame 39
 - 12 Torpedo compensating tanks
 - 13 Lubricating oil tank
 - 14 Dirty water tank
 - 15 Frame 40

- B5/2 PLAN OF HOLD AT PRESSURE HULL DECK LEVEL, TYPE VIIF**
- 1 Fuel oil tank
 - 2 Food store
 - 3 Refrigerator
 - 4 Fuel oil tank
 - 5 Senior rates' mess
 - 6 Ballast tank (initially fuel, with sea water replacing used fuel)
 - 7 Torpedo compensating tanks (fuel with sea water replacement)
 - 8 Refrigerator II
 - 9 Heads
 - 10 Negative buoyancy tank (port and starboard)
 - 11 Engine room
 - 12 Galley
 - 13 Walkway in torpedo storage compartment
 - 14 Main torpedo storage compartment
 - 15 Potato store access hatch
 - 16 Senior rates' number II mess
 - 17 Control room
 - 18 Officers' quarters and chief rates' mess

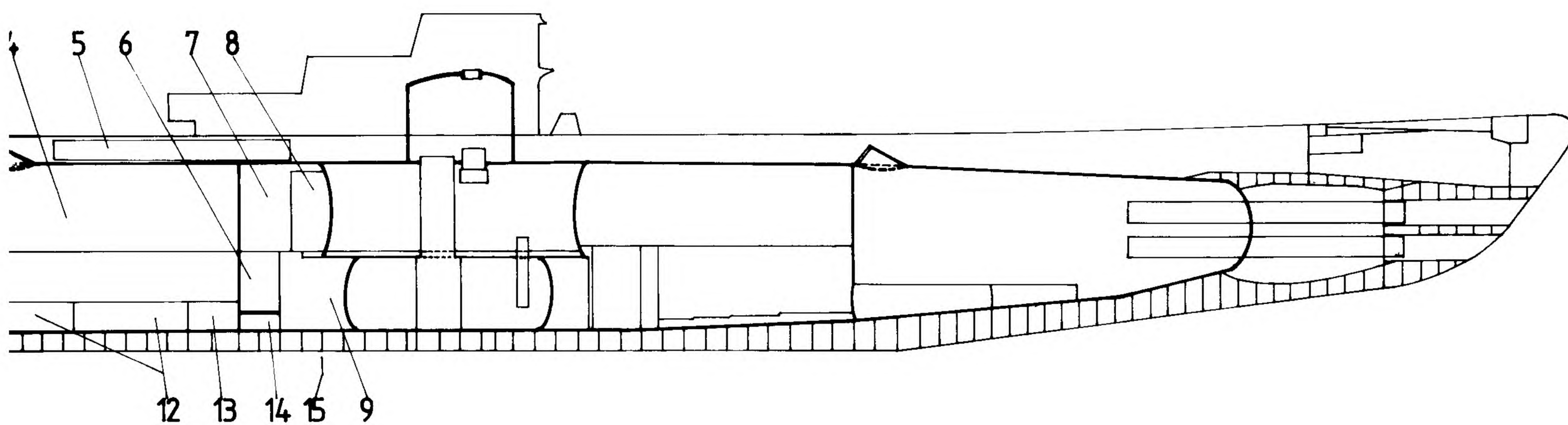
B4/2



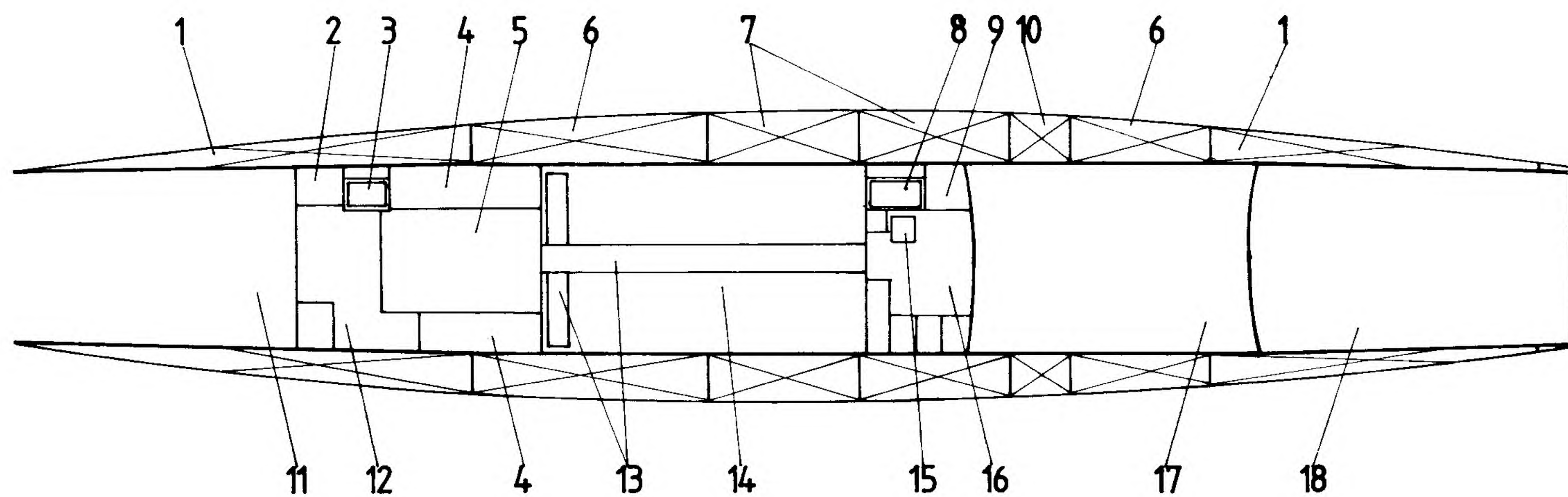
B4/3



B5/1

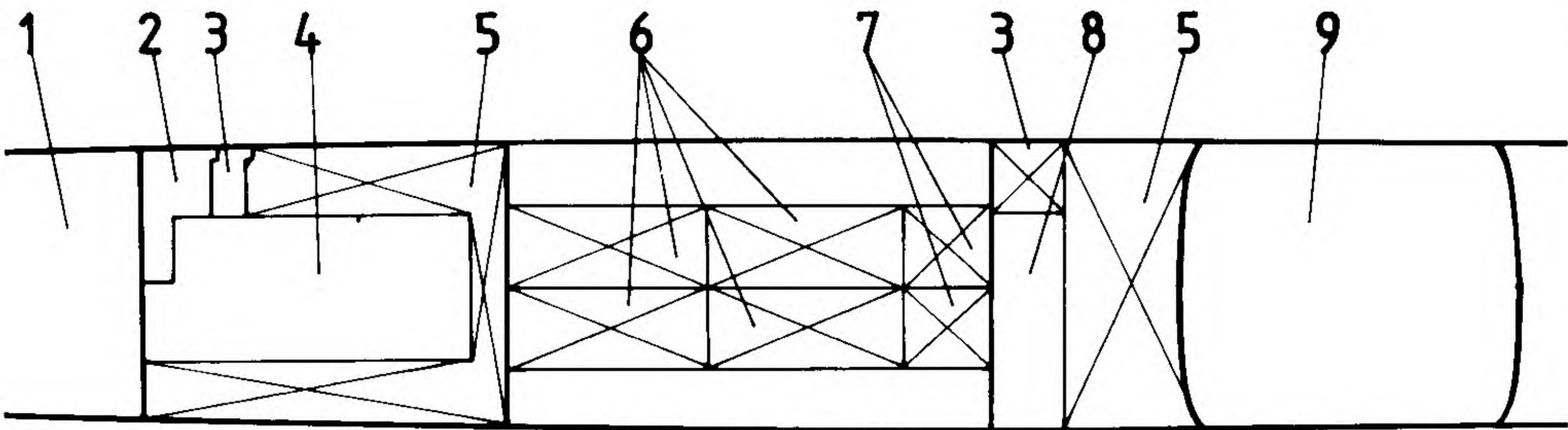


B5/2



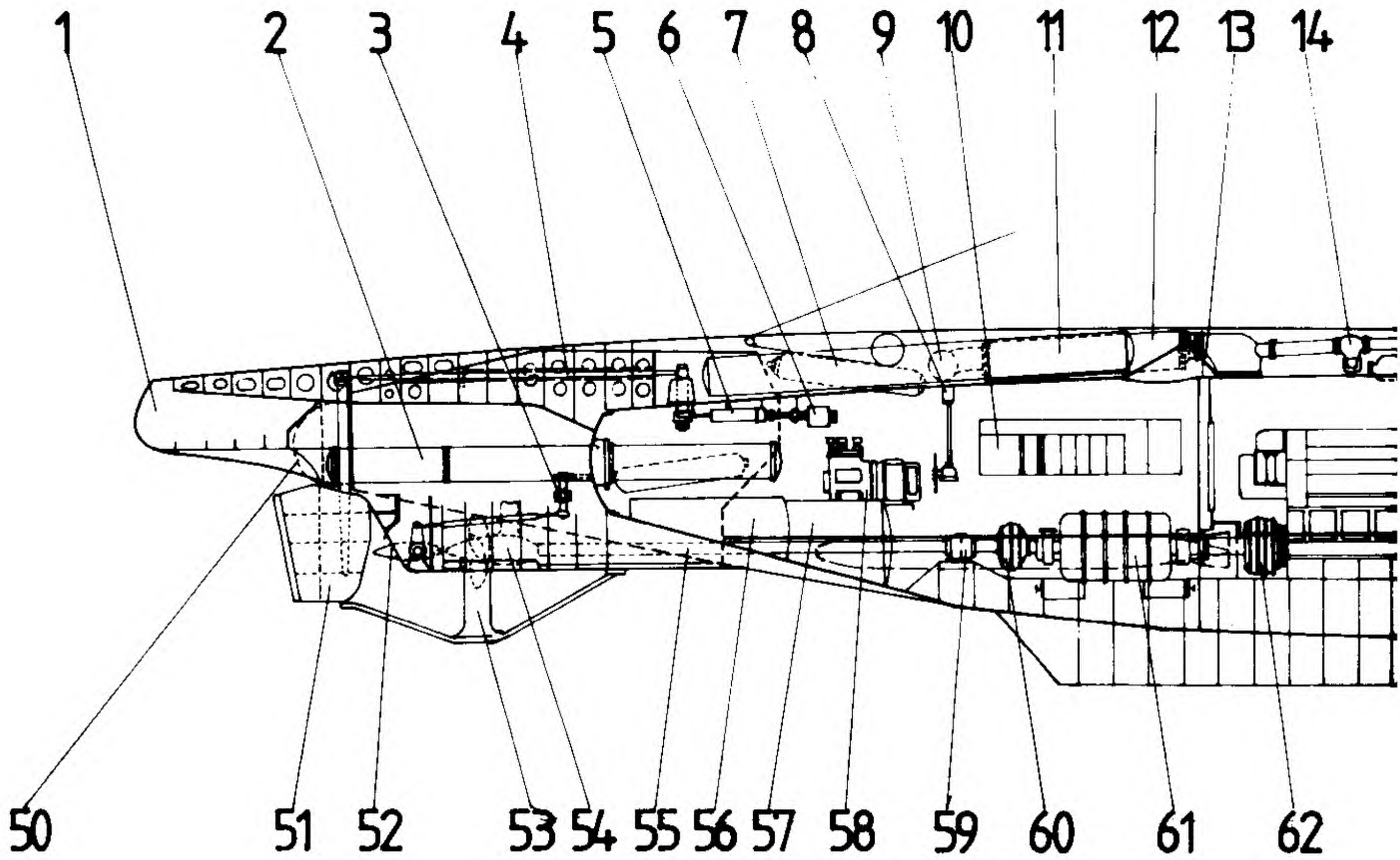
B General arrangements – internal

- B5/3** **INTERNAL PLAN, TORPEDO STORAGE COMPARTMENT, AT KEEL PLATING LEVEL, TYPE VIIF**
- 1** Engine room lower space
 - 2** Fresh water tank
 - 3** Dirty water tank
 - 4** Battery room I
 - 5** Fuel oil tank
 - 6** Torpedo compensating tanks
 - 7** Lubricating oil tanks
 - 8** Potato store
 - 9** Main diving tank

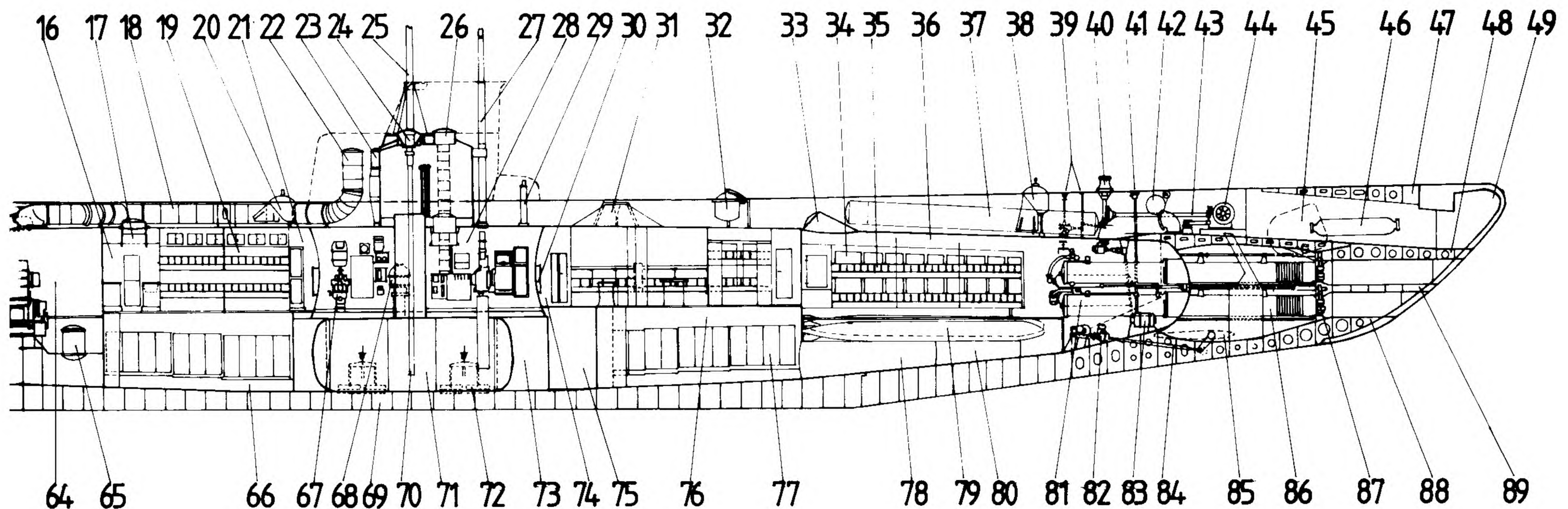


B5/3

B6

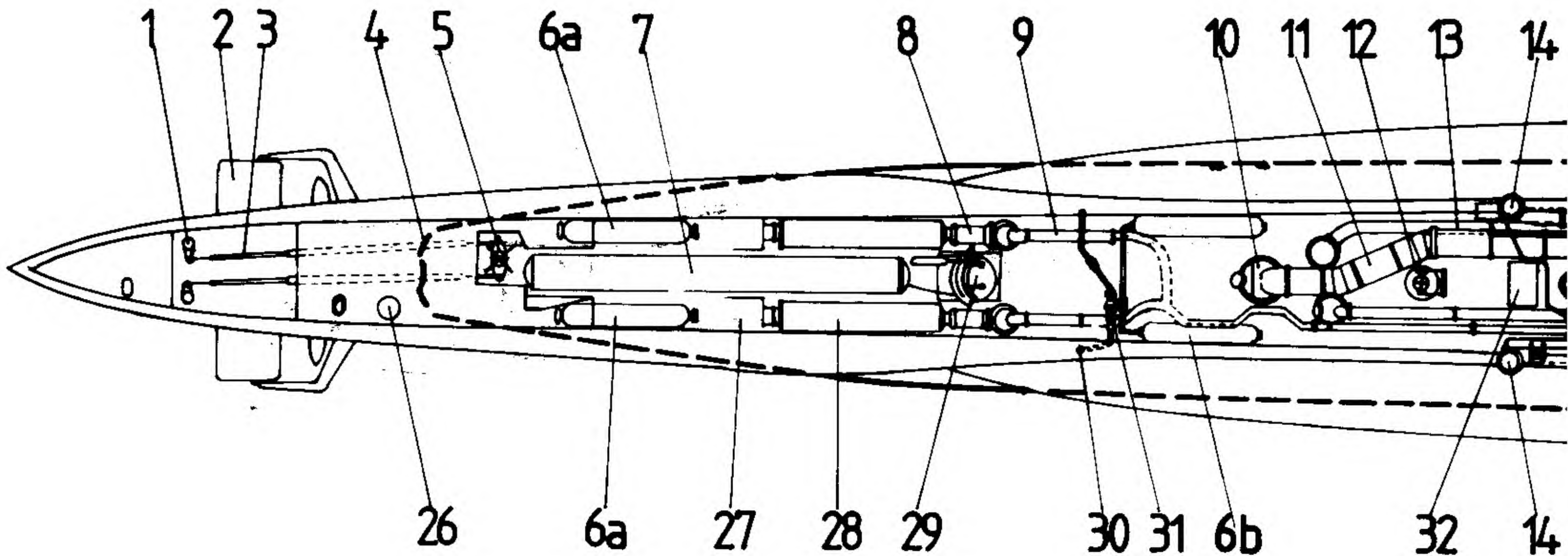


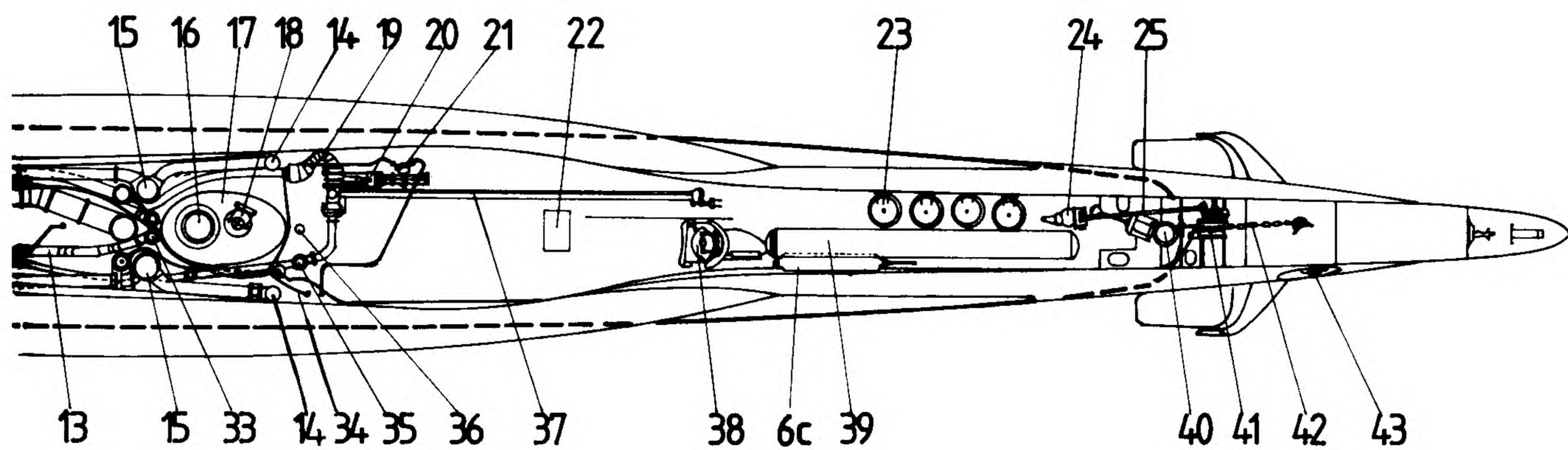
B6	LONGITUDINAL SECTION, TYPE VIIB	23	Boat air inlet mast (trunking not shown)	42	Spring-loaded pulley for aerial tension control	66	Aft battery room
1	Stern casing	24	Attack periscope sleeve	43	Drive arm for anchor winch	67	Main diving tank pump
2	Stringer III	25	Attack periscope	44	Anchor windlass	68	Master gyro compass
3	Stringer IV	26	Bridge access/escape hatch	45	Anchor housing (starboard only)	69	Keel
4	Rudder control shaft	27	Control room and air search periscope	46	High pressure air bottle	70	Attack periscope sleeve
5	Rudder control master cylinder			47	Bow support beam	71	Attack periscope well (dry)
6	Rudder control gear	28	Control room	48	Deck 'A' of bow	72	Main diving tank inlet valve (two)
7	High pressure air bottle	29	Main magnetic compass	49	Bow casing	73	Oil fuel tank li
8	Rudder control wheel	30	Internal bulkhead door	50	Stern torpedo tube opening	74	Radio stores locker
9	Diesel surface exhaust	31	Mounting for forward deck gun	51	Port rudder (one of two)	75	Magazine
10	Electrical control panel	32	Watertight ready-use locker (for 8.8cm ammunition)	52	Stern hydroplane (one of two)	76	Forward battery room
11	Deck reserve torpedo container	33	Forward torpedo loading hatch	53	Rudder support post (centreline)	77	Cells of battery room II
12	Diesel exhaust silencer	34	Locker (one of 18)	54	Propeller boss (one of two)	78	Torpedo compensating tank 2
13	Aft torpedo loading hatch	35	Bunk (one of 6)	55	Propeller shaft (one of two)	79	Reserve torpedo stowage
14	Diesel exhaust output exchange valve	36	Forward torpedo room and ratings' quarters	56	Stern trim tank	80	Forward trim tank
15	High pressure air bottle	37	Forward deck reserve torpedo casing	57	Torpedo compensating tank (port and starboard)	81	Torpedo tube III
16	Galley			58	Auxiliary generator	82	Forward hydroplane attitude control motor
17	Galley escape/access hatch	38	Forward 'subsunk' marker buoy	59	Propeller shaft bearing	83	Windlass and capstan motor
18	Diesel air inlet trunking	39	Controls for windlass/capstan	60	Gear box	84	Control transmission arm for forward hydroplanes
19	Aft quarters (senior rates)	40	Capstan head	61	Main electric motor (two)	85	Forward hydroplane (two)
20	'Subsunk' marker buoy (released from inside the boat)	41	Motor control for windlass/capstan (forward or backward motion control)	62	Engine gear box and clutch	86	Outer section of torpedo tube III
21	Washroom and heads			63	Main diesel engine (two)	87	Torpedo tube bow door
22	Diesel surface air inlet mast			64	Engine room	88	Bow casing deck 'A'
				65	Engine oil sump	89	Bow casing deck 'C'



B General arrangements – internal

B7/1	PLAN OF PIPING AND TRUNKING UNDER OUTER CASING DECK, TYPE VIIC					
1	Rudder post	15	and tank 4 (forward)	31	compressor	
2	Port aft hydroplane		16	Main valve controlling blowing of diving tanks 2 and 4	32	Air compressor
3	Port rudder control linkage	16	Attack periscope shaft and watertight gland	33	Battery hatch	
4	Outline of pressure hull	17	Top of attack centre pressure hull	34	Air inlet (starboard) to diesel engine (surface running)	
5	Rudder control linkage coaxial head	18	Bridge hatch	34	Hydraulic hose (Schnorchel control system)	
6	Group I high pressure air cylinders ('a', 'b' and 'c' are air groups)	19	Air input trunking for diesel engine (port)	35	Cut-off valve for Schnorchel system (when running below Schnorchel depth)	
7	Stern reserve torpedo canister	20	Schnorchel raising/lowering piston		Schnorchel depth)	
8	Diesel exhaust feed to silencer (shown aft)	21	Schnorchel hydraulic control valve	36	Control room periscope sleeve and gland	
9	Exhaust air input	22	Battery hatch	37	Schnorchel mast (shown in horizontal position)	
10	Diesel air intake lower valve	23	One of four containers for 5 man inflatable life rafts	38	Forward torpedo loading hatch	
11	Air inlet trunking	24	Anchor windlass motor	39	Forward reserve torpedo canister	
12	Galley hatch	25	Anchor windlass drive shaft	40	Air outlet valve for diving tank 5	
13	Air input trunking for air circulation motor	26	Air outlet valve for diving tank I	41	Anchor windlass drum	
14	Diving tank 2 blowing valve (aft)	27	Diesel exhaust	42	Anchor chain	
		28	Starboard diesel exhaust silencer	43	Anchor (standard German Navy Halle pattern)	
		29	Aft torpedo loading hatch			
		30	Air inlet and piping feeding air			

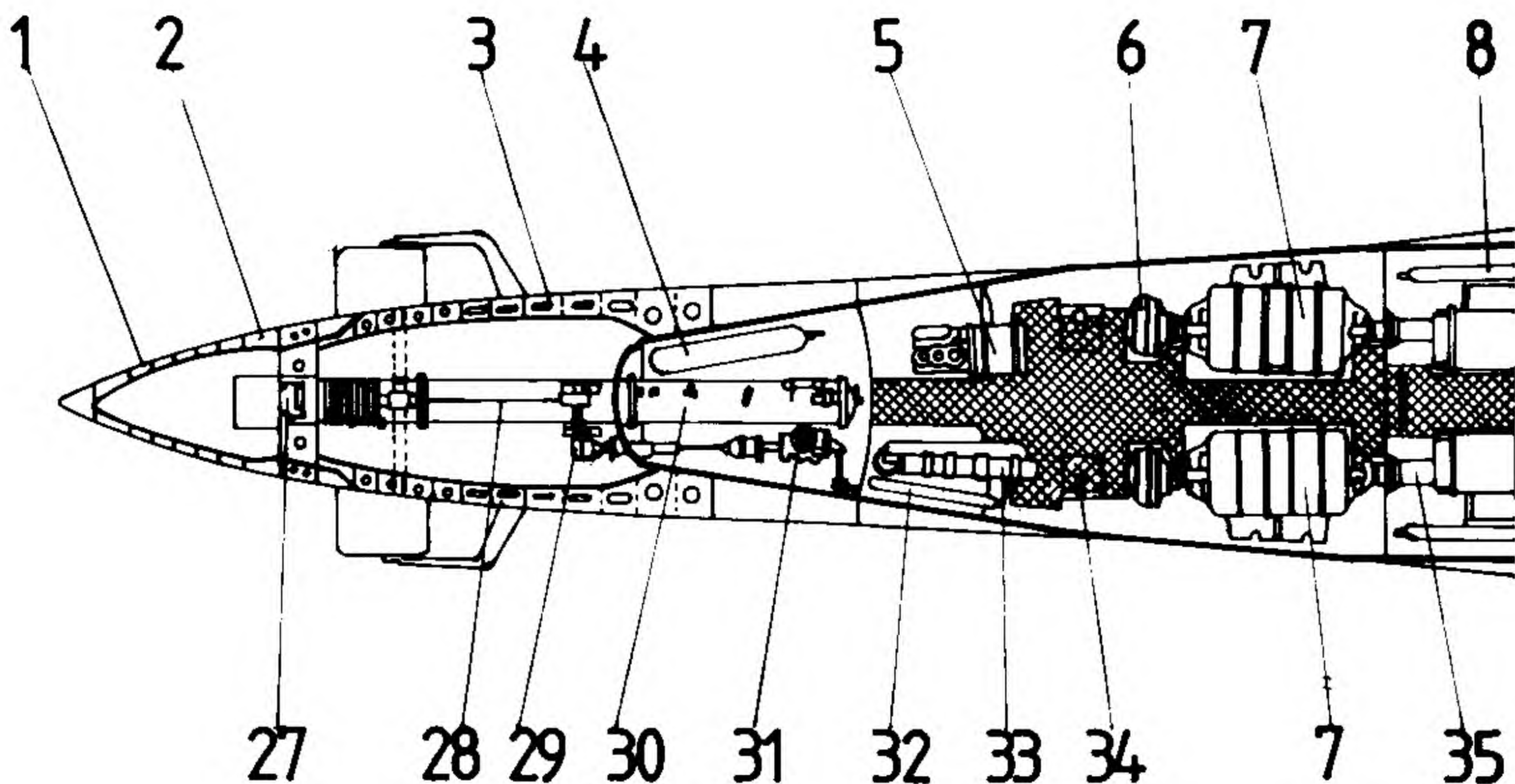




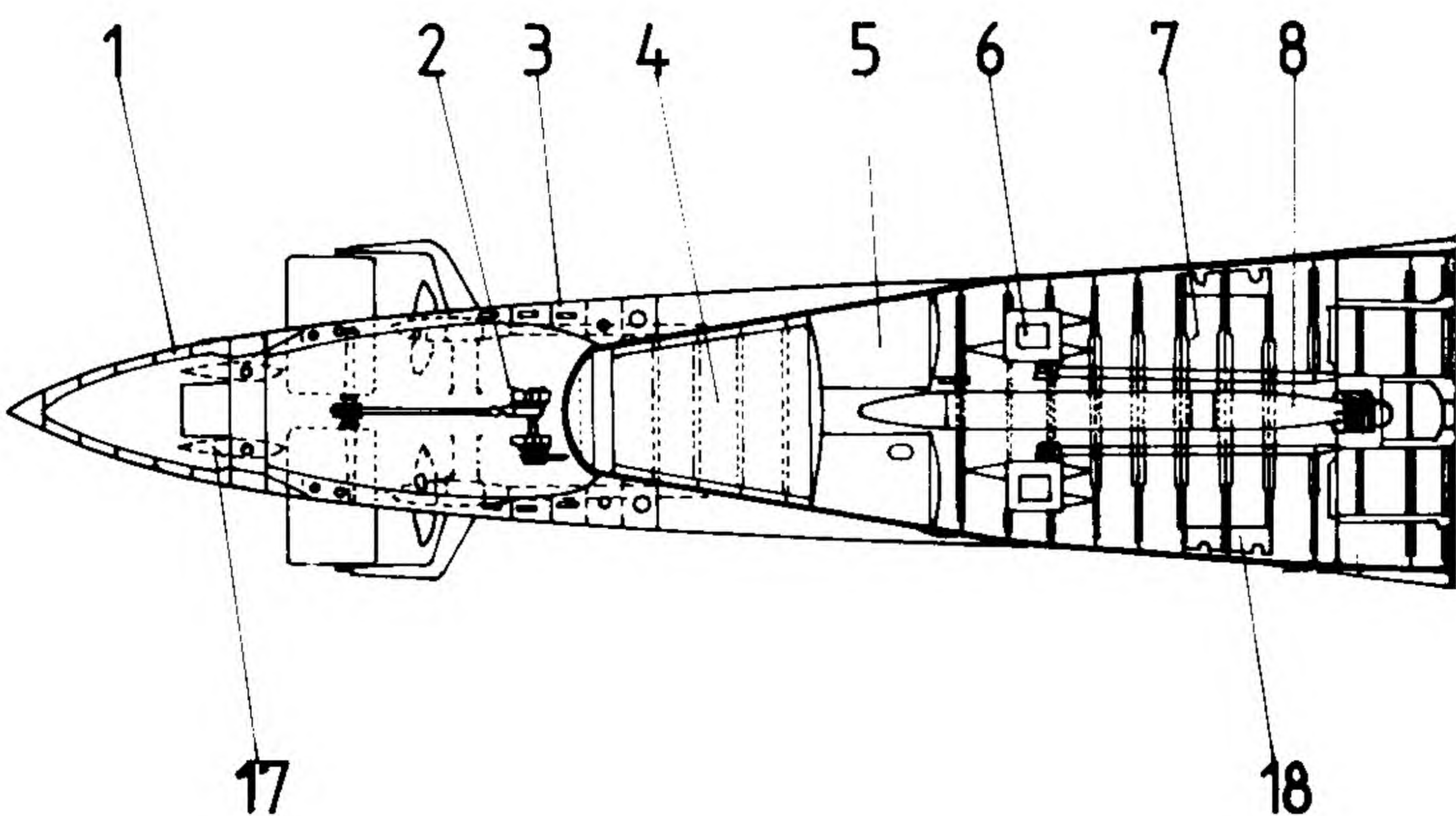
B7/1

B General arrangements – internal

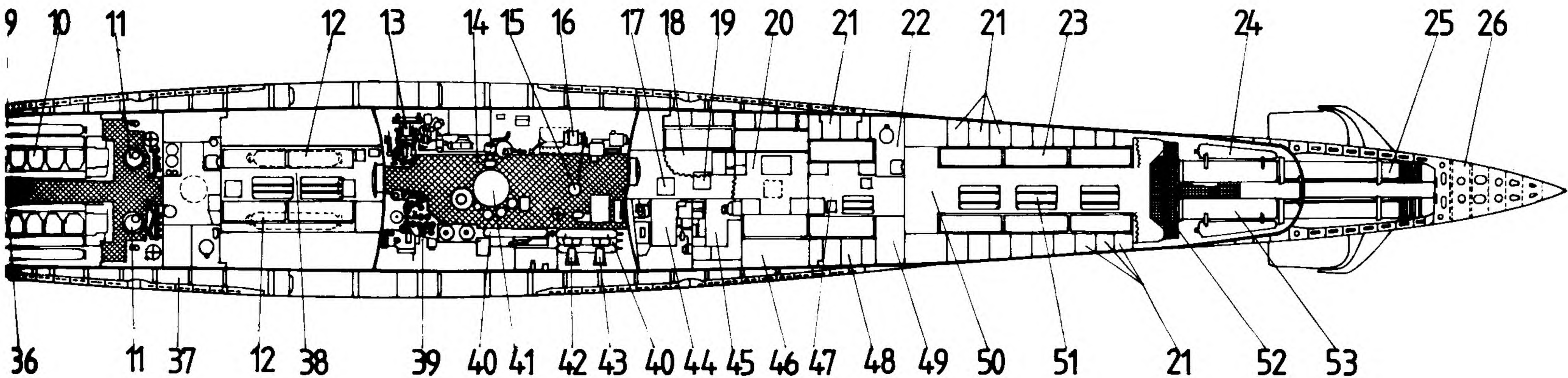
B7/2	INTERNAL WORKING DECK PLAN, TYPE VIIC	27	Stern torpedo tube door
1	Stringer	28	Stern hydroplane control arm
2	Stringer	29	Stern hydroplane control motor
3	Stringer	30	Stern torpedo tube
4	High pressure air supply for torpedo tube V	31	Stern hydroplane hydraulic servo motor
5	Auxiliary generator	32	Oxygen bottles
6	Main reduction gearing and clutch	33	Junkers air compressor
7	Main electric motor	34	Motor room deck support pedestal
8	High pressure oxygen bottles	35	Drive shaft
9	High pressure air for starting diesel engines	36	Engine room deck
10	Diesel engine	37	Starboard saddle tank
11	Oil cooler	38	Engineers' mess
12	High pressure air group 3	39	Main control station for all diving and trim tanks
13	Main diving tank voiding pump	40	Oxygen bottles
14	Deck plating	41	Attack periscope trunking and sleeve
15	Control room periscope sleeve	42	Aft hydroplane control station (hydraulic/manual)
16	Control room periscope drive motor	43	Forward hydroplane control station
17	Access hatch to magazine	44	Radio room
18	Captain's quarters	45	Sound room
19	Access to S-Gerät space	46	Drinking water tank 3
20	Officers' mess	47	Chief rates' quarters
21	Lockers	48	Lockers
22	Heads and washroom	49	Food store
23	Bunks	50	Forward torpedo room and ratings' quarters
24	High pressure air supply for port torpedo tubes	51	Leaf table
25	Torpedo tube	52	Non-slip deck
26	Bow casing deck 'D'	53	Torpedo tube III



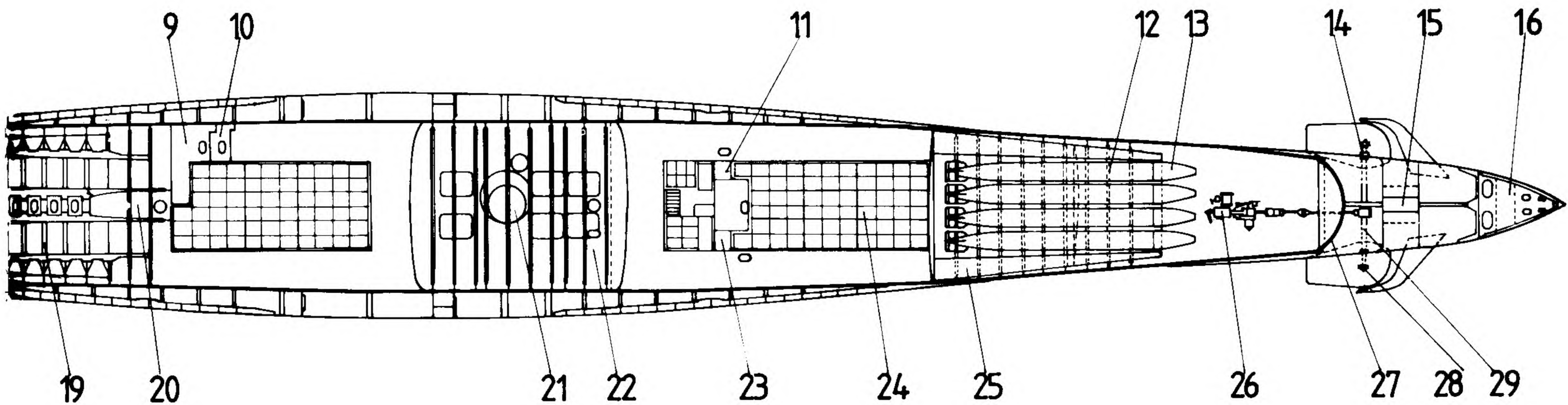
B7/3	INTERNAL PLAN AT LEVEL OF HOLD, TYPE VIIC	15	Anchor chain well
1	Stringer III	16	Bow casing
2	Hydroplane drive motor	17	Starboard rudder
3	Stringer II	18	Clutch pedestal (electric motor)
4	Stern trim tank	19	Main bilge supports, diesel engines
5	Torpedo compensating tank	20	Diesel room bilge
6	Electric motor mounting	21	Attack periscope well
7	Motor room bilge	22	Main diving tank
8	Reserve torpedo	23	Washing water tank
9	Clean water tank	24	Battery room II
10	Foul water tank	25	Support beam, forward torpedo storage space
11	Foul water tank	26	Forward hydroplane drive motor
12	Reserve torpedo storage	27	Bow cap of pressure hull
13	Reserve torpedoes—not fitted with pistols	28	Forward hydroplane arm cap
14	Forward hydroplane	29	Forward hydroplane arm



B7/2



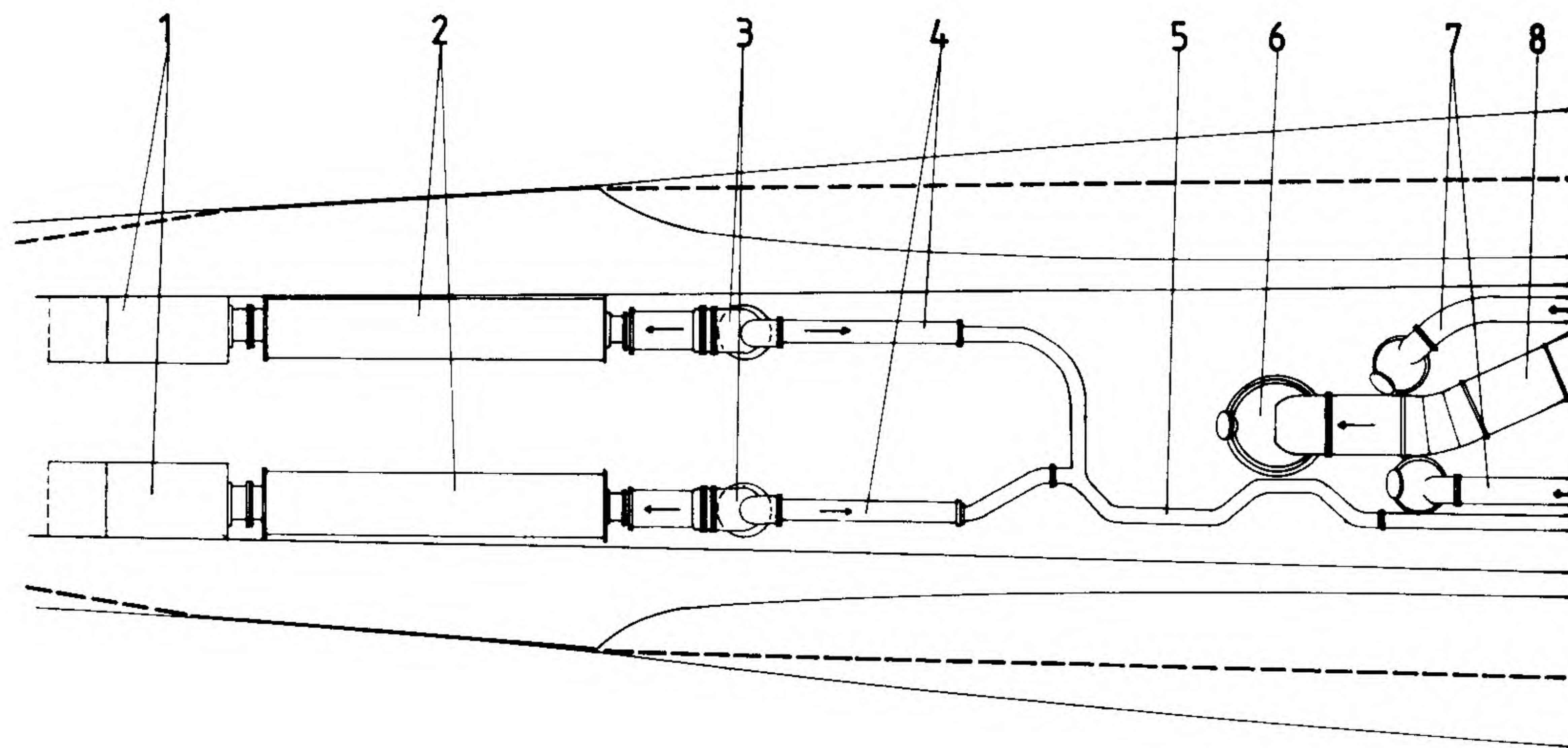
B7/3



B General arrangements – internal

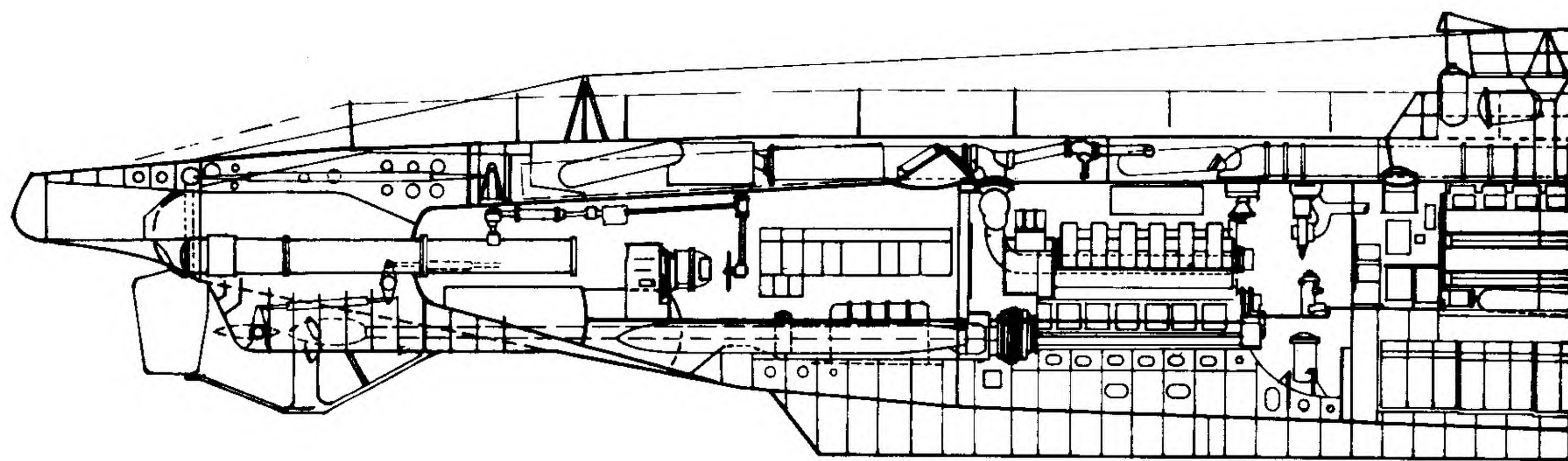
B7/4 AIR SUPPLY AND EXHAUST TRUNKING FOR BOATS FITTED WITH SCHNORCHEL, TYPE VIIC (1/100 scale)

- 1 Diesel exhaust outlets
- 2 Diesel exhaust silencer boxes
- 3 Exhaust outlet control valves and pressure casing apertures
- 4 Schnorchel exhaust pipes
- 5 Single exhaust to Schnorchel
- 6 Engine air inlet (surface or Schnorchel run)
- 7 Air inlets to engine room (surface running only)
- 8 Main air inlet trunking
- 9 Main surface air inlet (note Schnorchel connection immediately aft)
- 10 Air inlet masts (surface running)
- 11 Schnorchel trunking (extra to standard fittings)
- 12 Conning tower outline
- 13 Schnorchel air inlet connection, operating only when Schnorchel mast raised
- 14 Diesel exhaust to Schnorchel (operating only when Schnorchel mast raised)

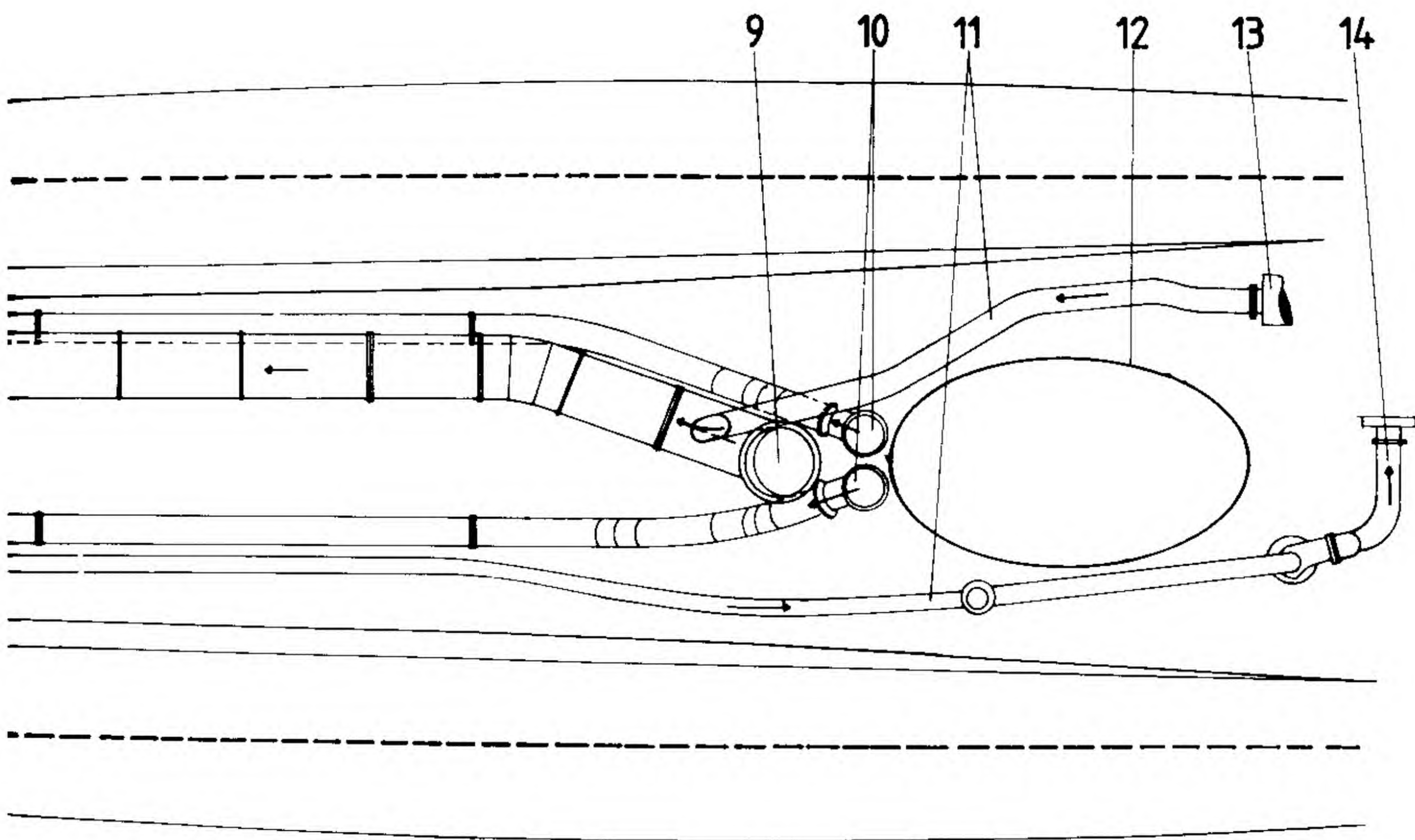


B7/5 LONGITUDINAL SECTION, TYPE VIIC/41

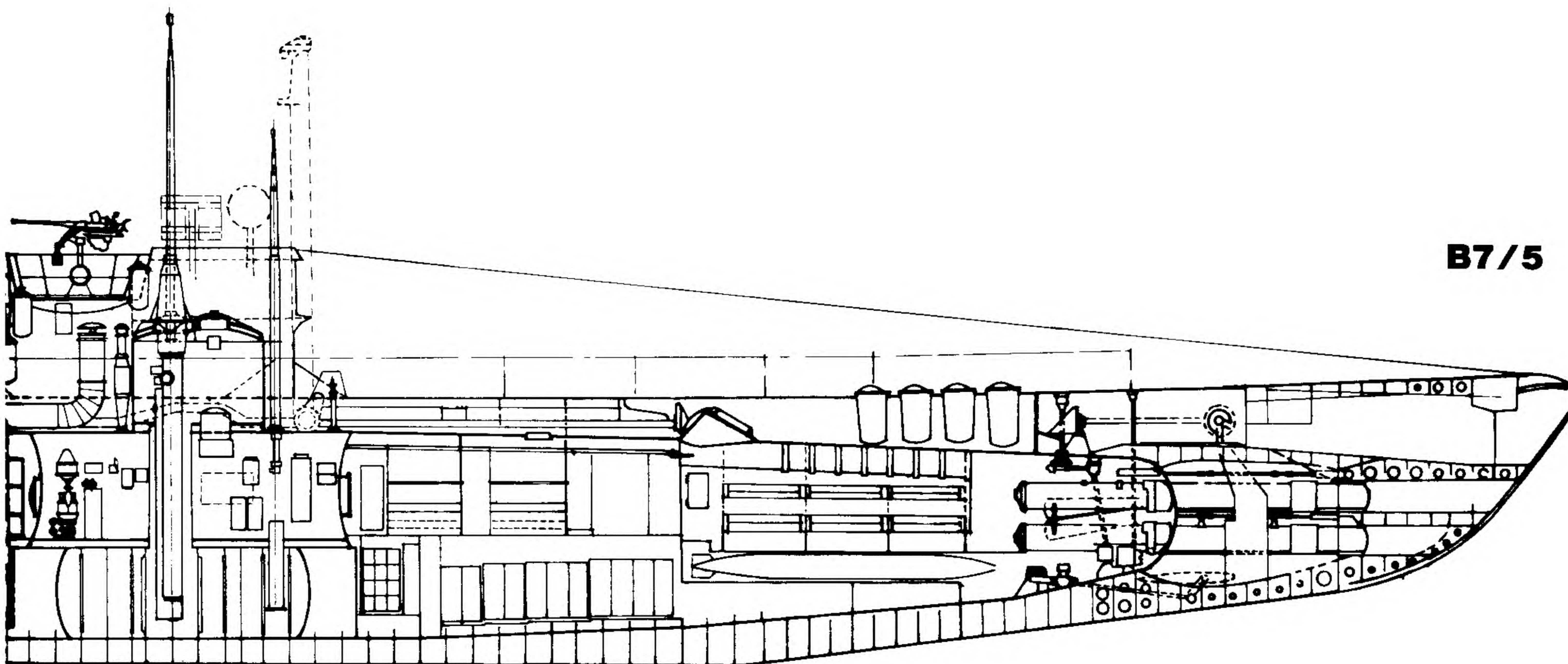
This general section of a VIIC/41 shows the internal arrangement of the boats. The greater sophistication of the tower is the most obvious point, as well as the increased provision for escape rafts (forward, and in the lower 'Wintergarten' position). The drawings of the individual compartments in Section D are annotated to give full details.



B7/4

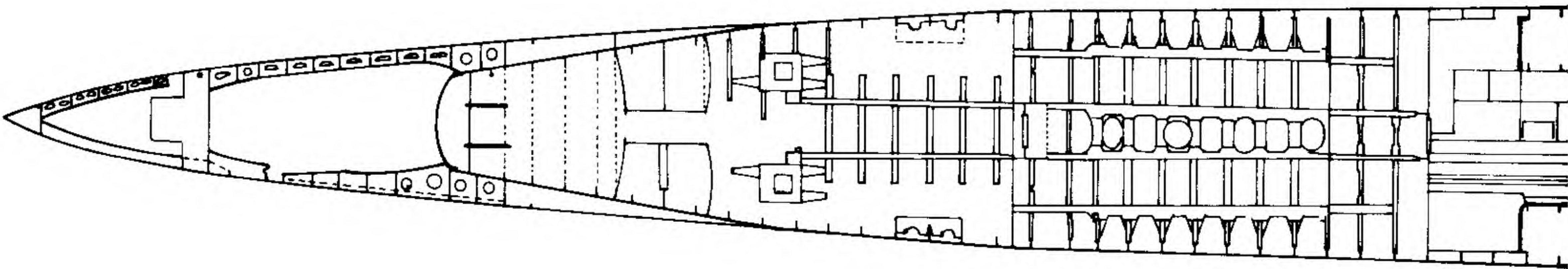
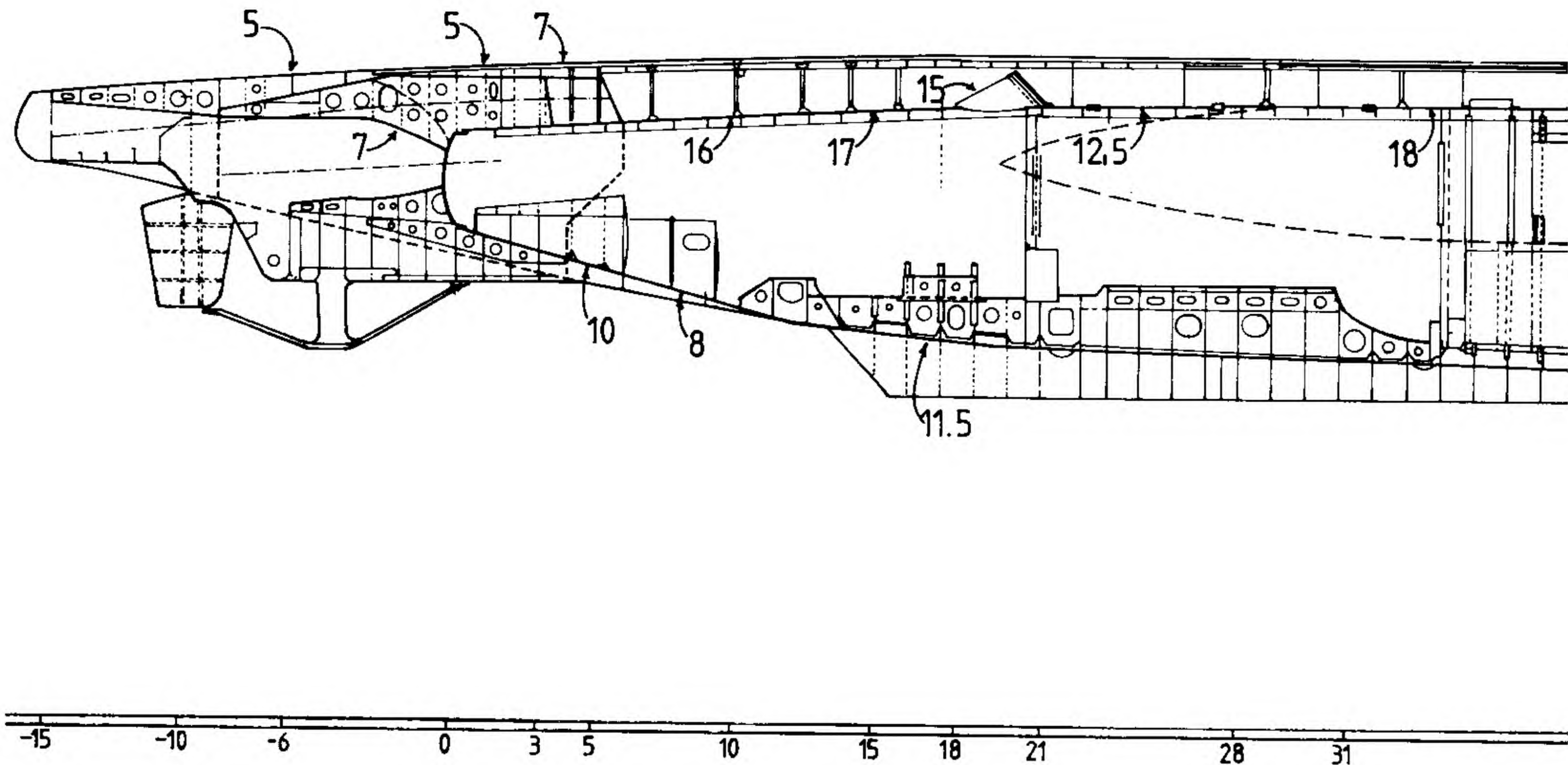


B7/5



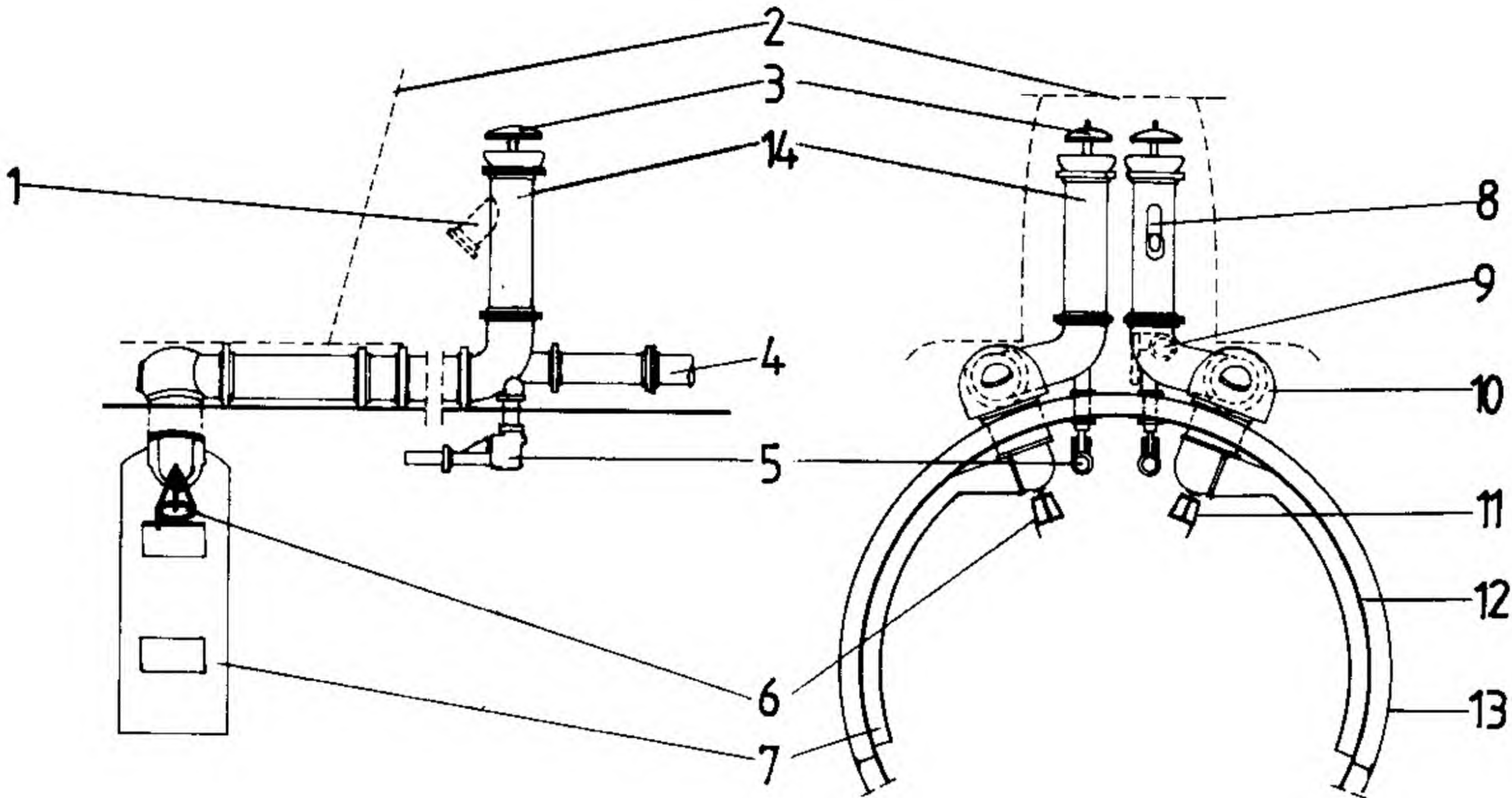
B General arrangements – internal

B7/6 PLATING THICKNESSES (IRON PLAN), TYPE VIIC/41 (elevation and lower deck plan)
The boat is shown in longitudinal section with plate thicknesses in millimetres. The contents of each section are shown in the more detailed plans, as are the fittings of the lower deck plan.

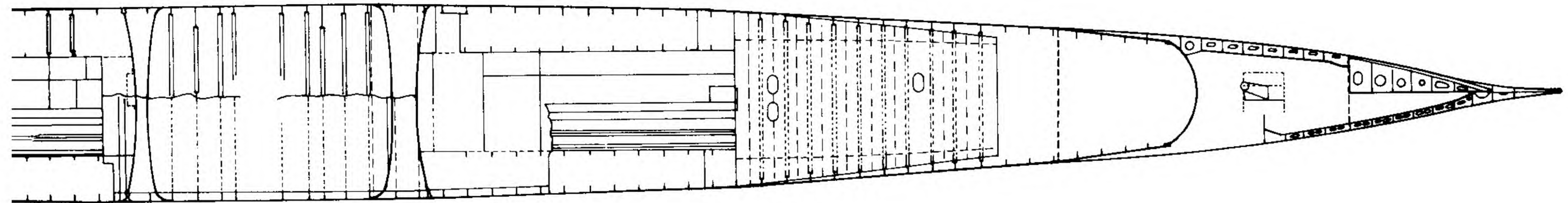
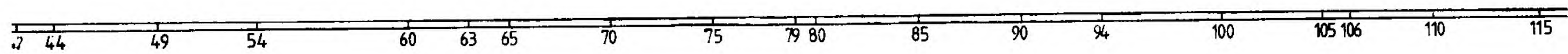
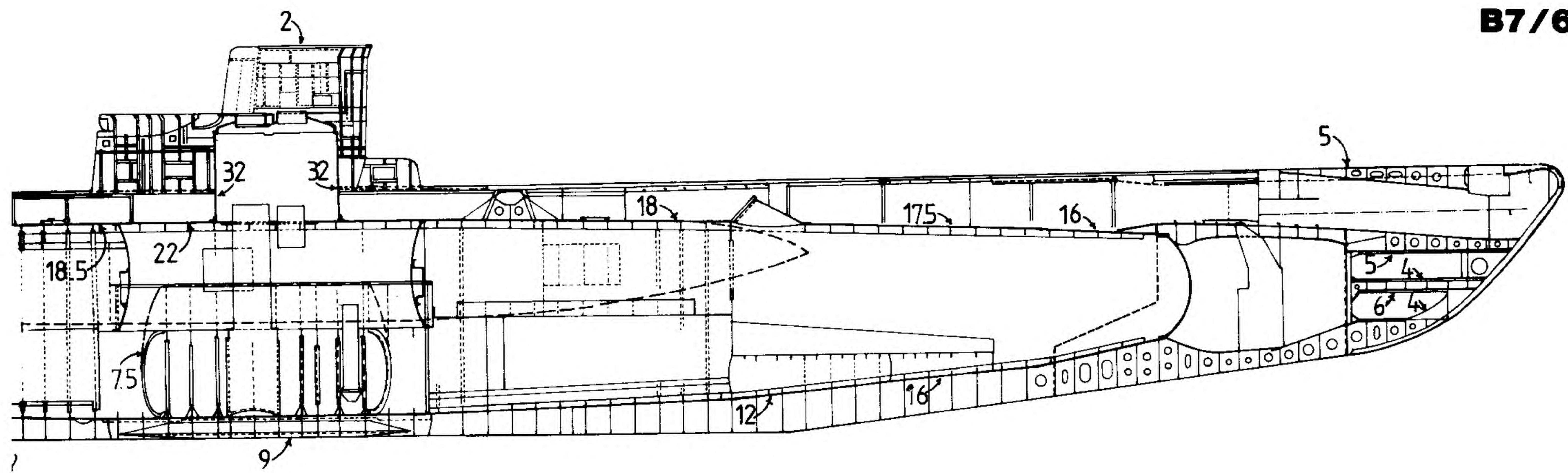


B7/7 TYPE VIIC MAIN AIR INLET MASTS AND TRUNKING (aft part of conning tower; no scale)

- 1 Connector to boat air supply (starboard only)
- 2 Line of bridge casing
- 3 Air inlet heads
- 4 Schnorchel connector pipe
- 5 Boat air supply junction
- 6 Diesel room air supply control valve
- 7 Diesel room air inlets
- 8 Boat air supply connector slide control
- 9 Forward inlet pipe to Schnorchel
- 10 Protective cap and gland
- 11 Motor room control valve
- 12 Pressure hull
- 13 Outer casing
- 14 Air inlet masts

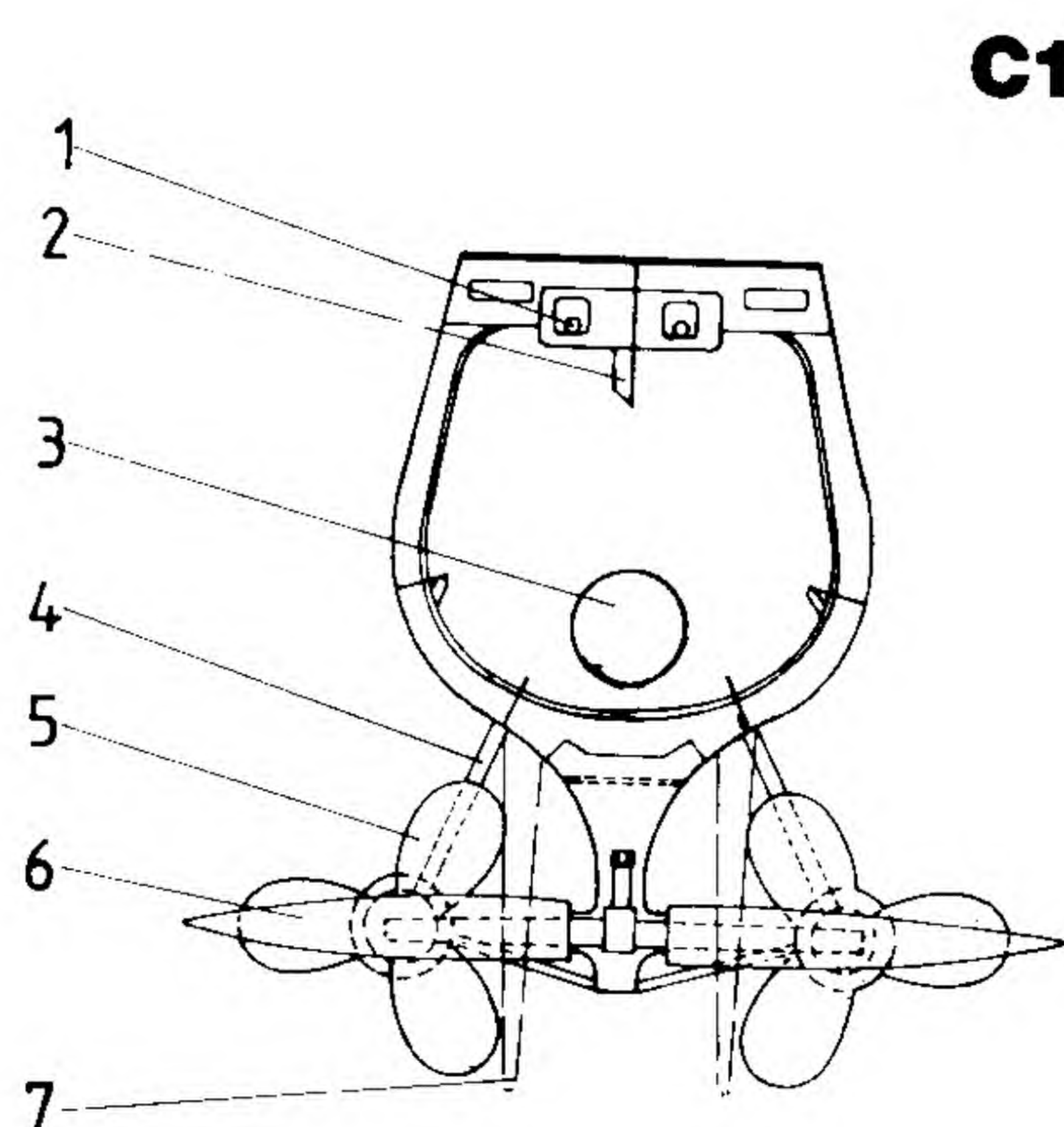


B7/7

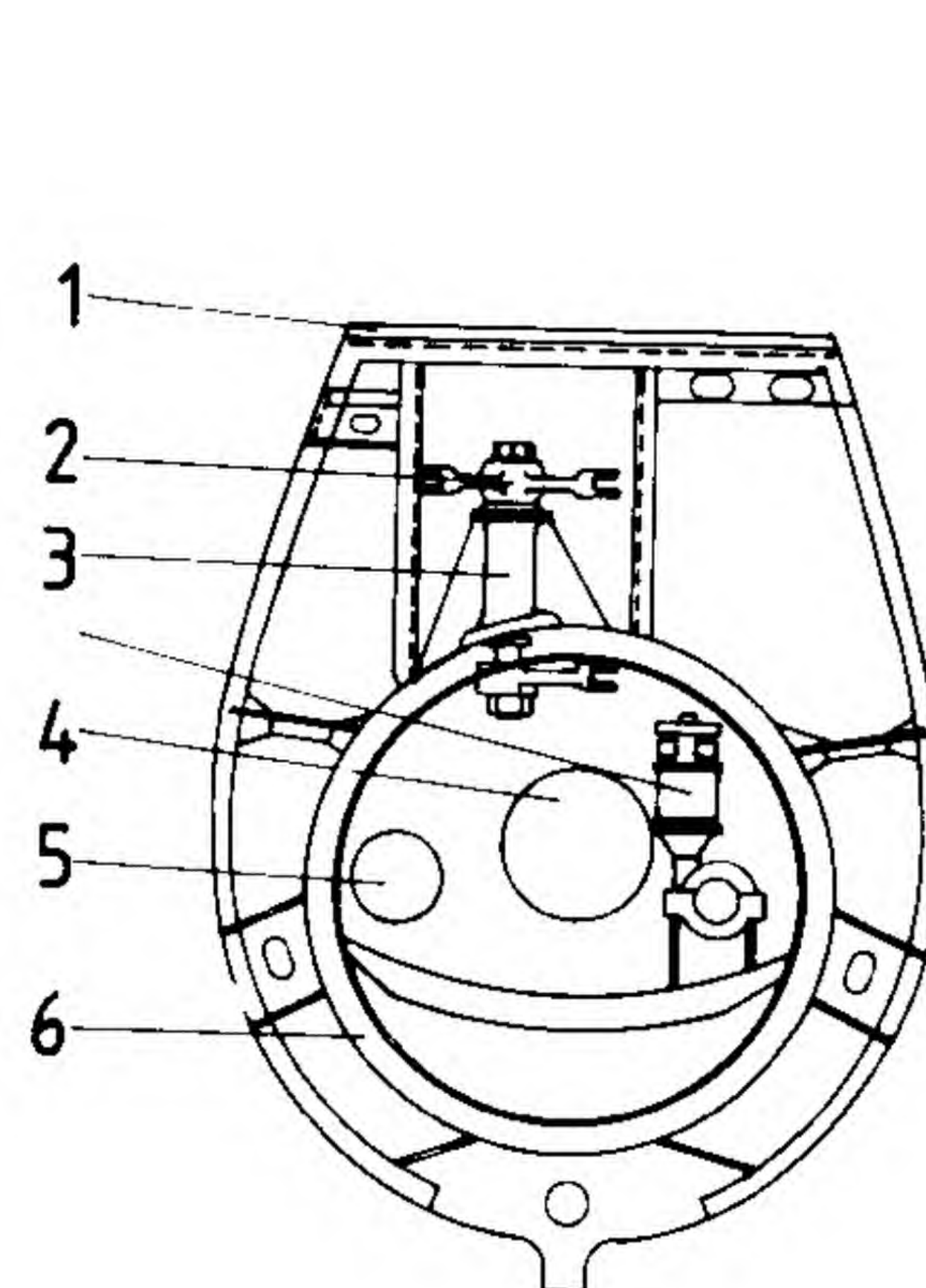


C Hull sections

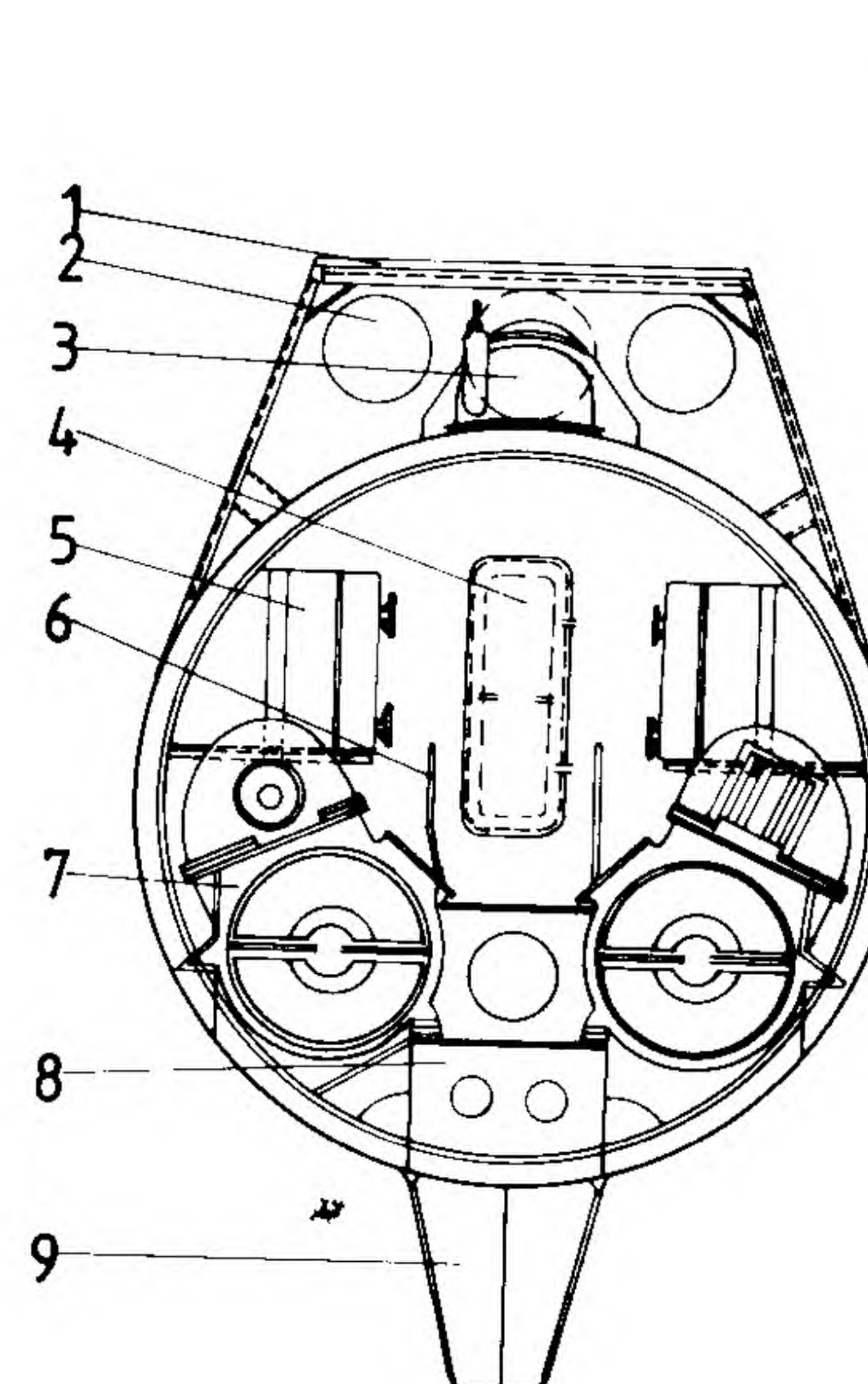
C1-11 TYPE VIIC HULL SECTIONS (all to 1/100 scale)



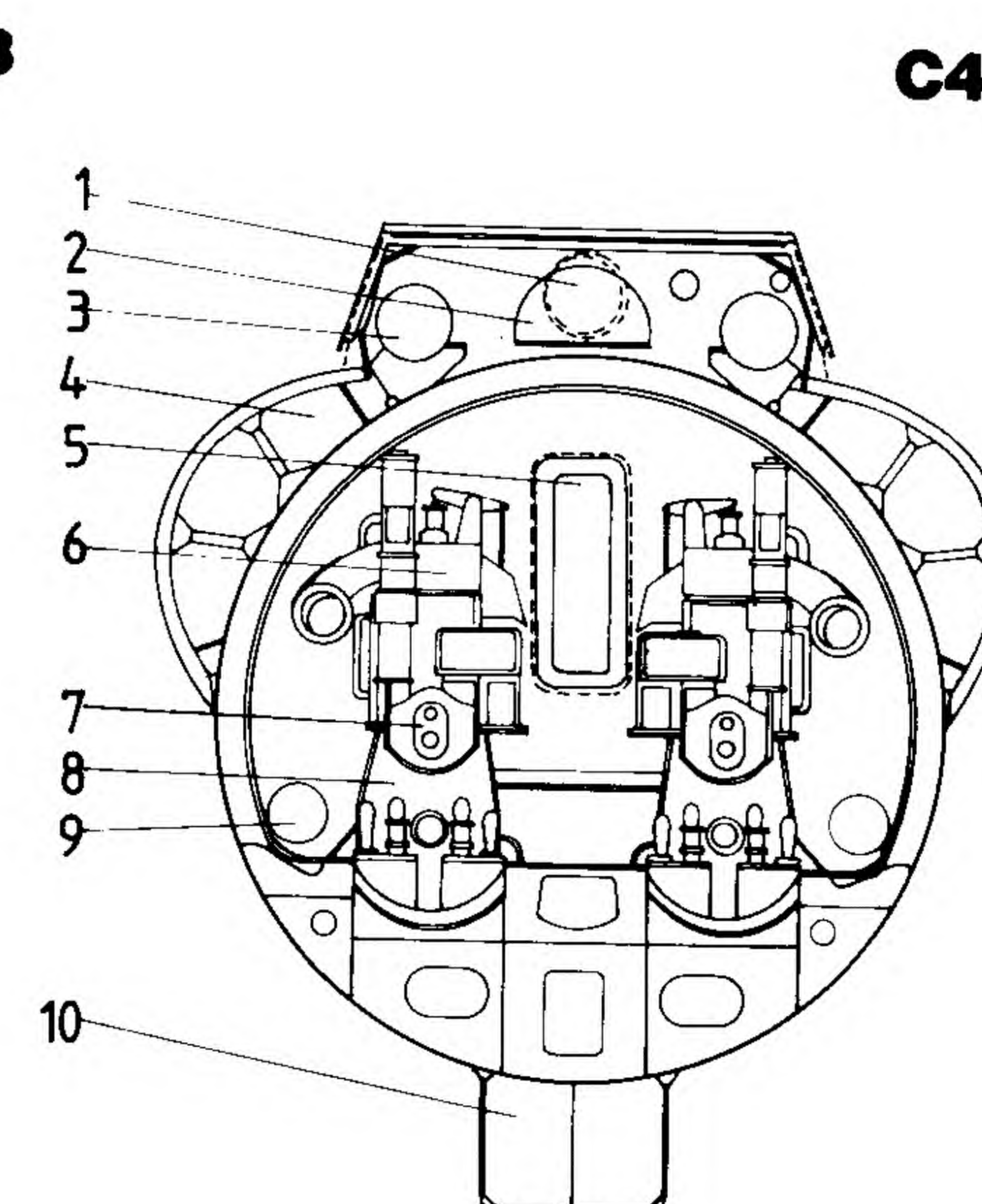
- C1 SECTION AT STERN HYDROPLANE MOUNTING**
- 1 Rudder control arm
 - 2 Knee beam
 - 3 Stern torpedo tube (number V)
 - 4 Support bracket for propeller shaft
 - 5 Propeller blade
 - 6 Hydroplane
 - 7 Line of rudder (aft of section point)



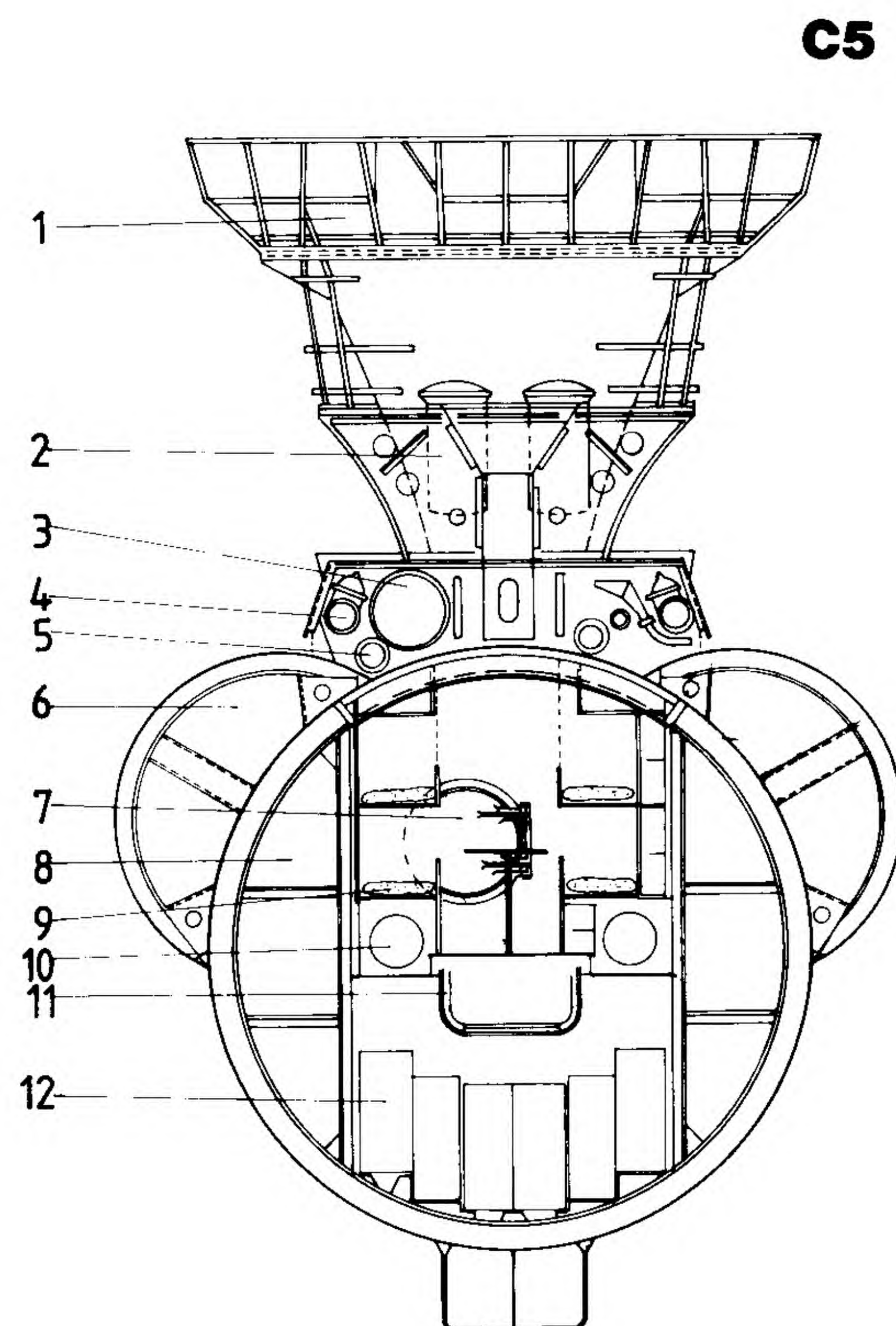
- C2 SECTION AT STERN OF AFT TORPEDO ROOM**
- 1 Casing deck
 - 2 Rudder control arm head
 - 3 Mounting for rudder arm head
 - 4 Torpedo tube V
 - 5 High pressure air bottle
 - 6 Pressure hull



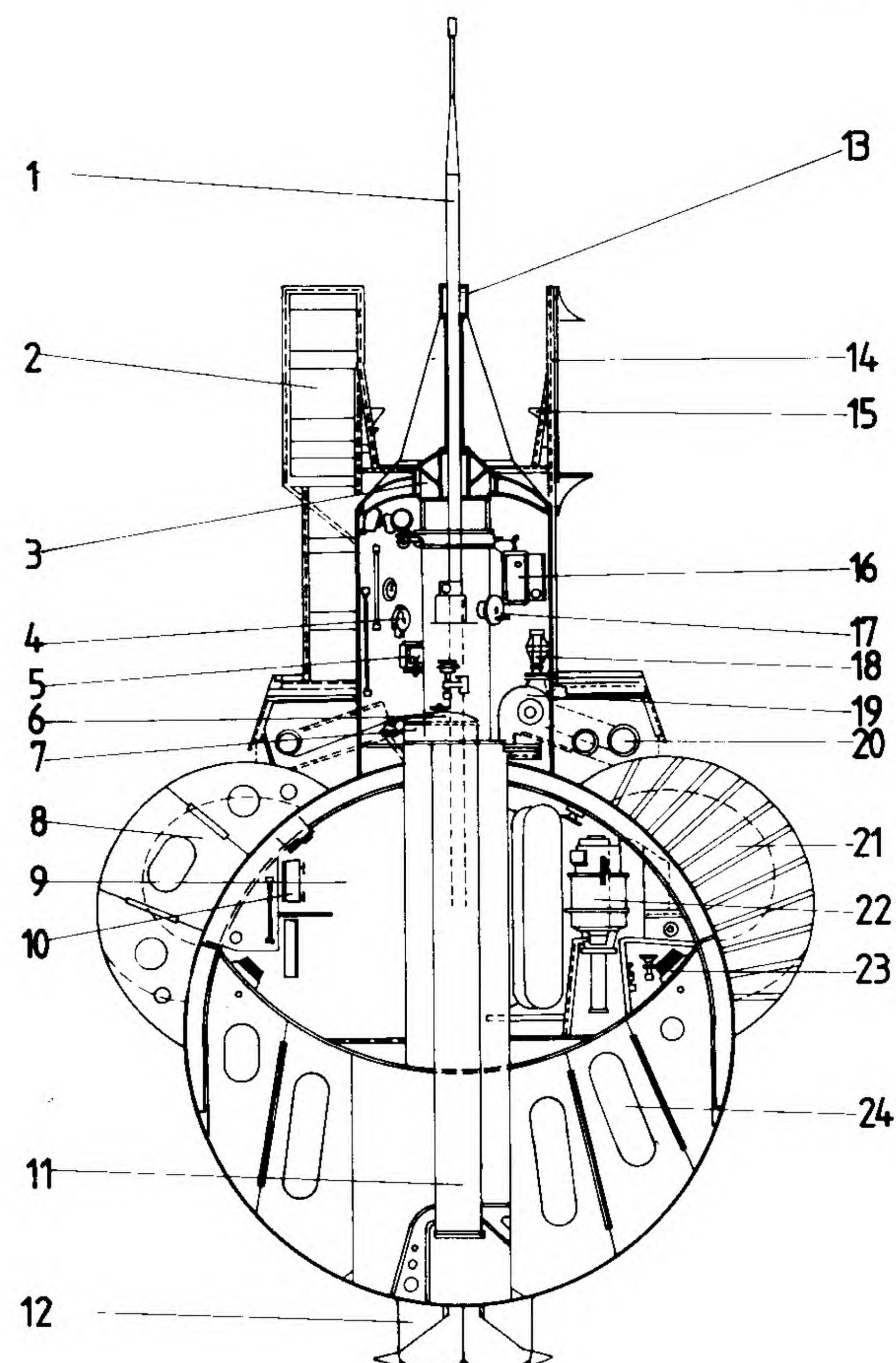
- C3 SECTION AT MOTOR ROOM**
- 1 Casing deck
 - 2 Diesel exhaust
 - 3 Aft torpedo loading hatch
 - 4 Access door to stern room
 - 5 Starboard electrical control board
 - 6 Safety railing
 - 7 Starboard electric motor
 - 8 Support housing
 - 9 Keel



- C4 SECTION AT DIESEL COMPARTMENT**
- 1 Reserve torpedo container
 - 2 Diesel exhaust
 - 3 Diesel air inlet trunking
 - 4 Starboard saddle-tank
 - 5 Access door to motor room
 - 6 Starboard diesel engine
 - 7 Starter motor
 - 8 Engine mounting
 - 9 High pressure air cylinder for engine starter
 - 10 Keel

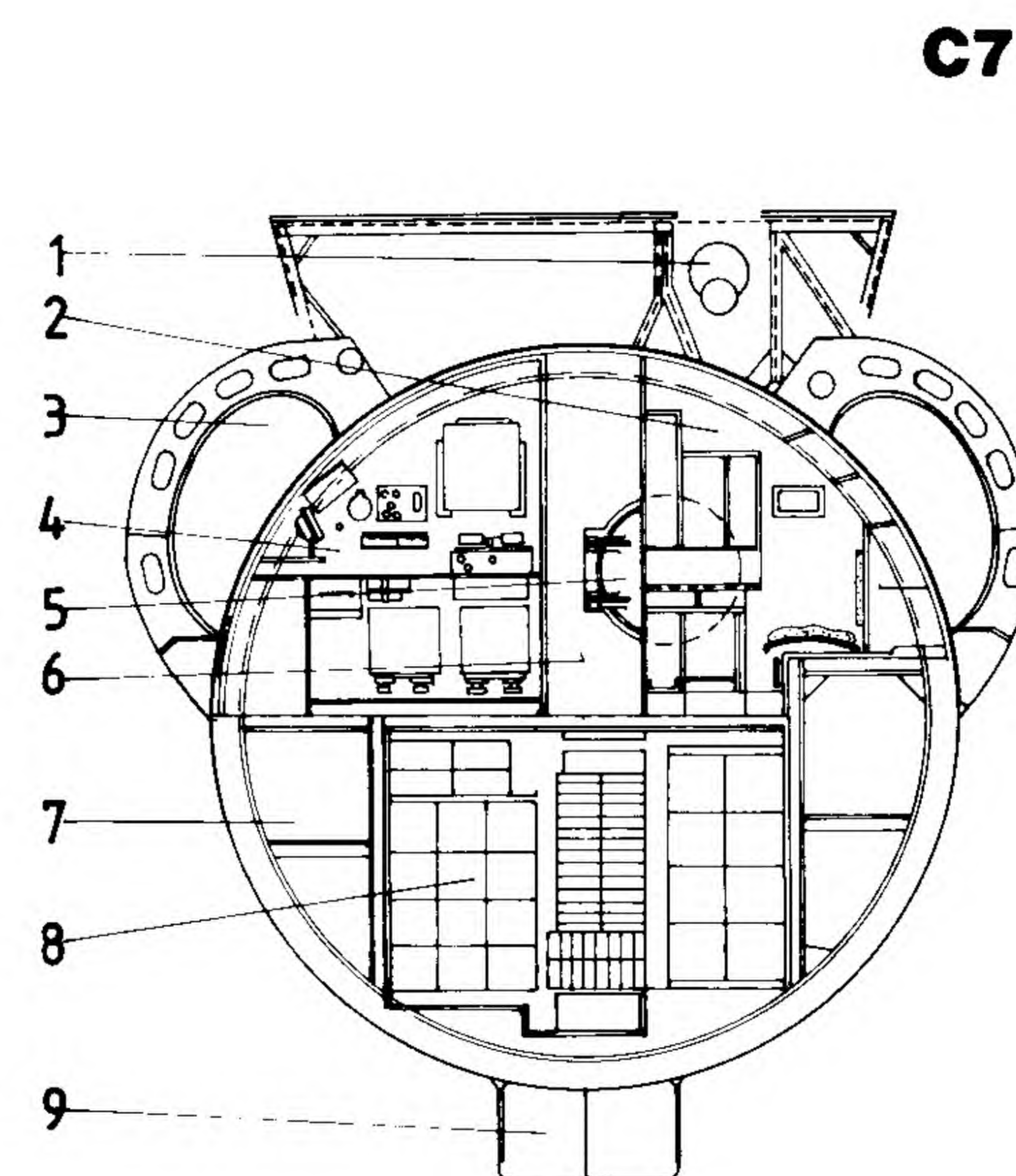


- C5 SECTION AT ENGINEERS' MESS**
- 1 Upper gallery of 'Wintergarten'
 - 2 Ammunition container (watertight)
 - 3 Main air inlet to diesel engines
 - 4 Engine compartment ventilation piping
 - 5 Diesel exhaust to Schnorchel
 - 6 Starboard saddle-tank
 - 7 Access hatch to control room
 - 8 Main fuel bunker II
 - 9 Bunk
 - 10 High pressure air bottles group 3
 - 11 Battery service and lifting tray
 - 12 Battery cells of battery room I



- C6 SECTION AT CONTROL ROOM AND TOWER (looking forward)**
- 1 Attack periscope
 - 2 Aerial housing
 - 3 Attack periscope gland
 - 4 Engine room repeater
 - 5 Kirek torpedo firing lever
 - 6 Access hatch to tower
 - 7 Hatch casing
 - 8 Port saddle-tank
 - 9 Control room
 - 10 Tank state indicator
 - 11 Attack periscope housing
 - 12 Keel

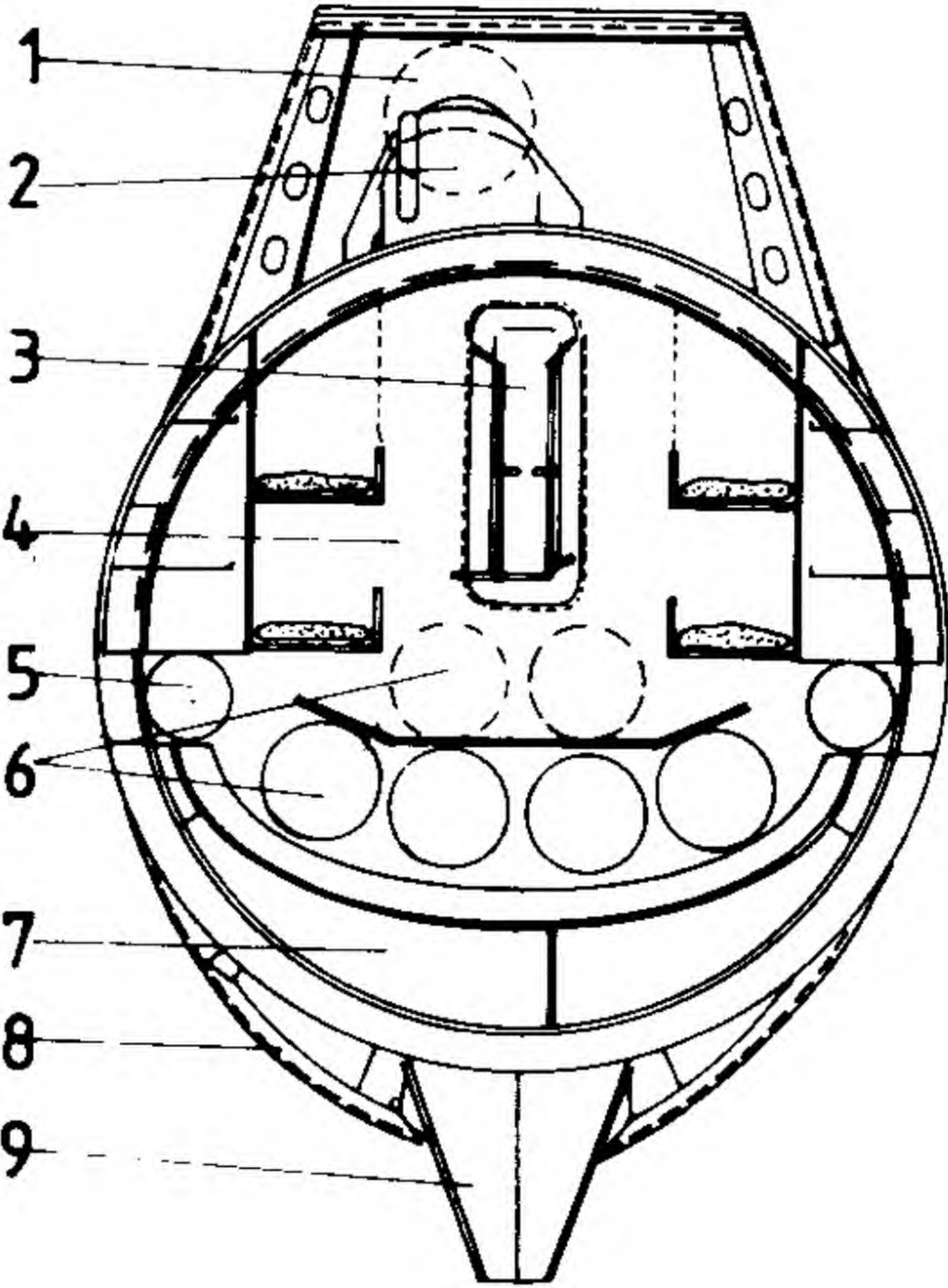
- 13 Upper periscope sleeve
- 14 Bridge casing
- 15 Observation step
- 16 Attack computer
- 17 Periscope control wheel
- 18 Heater
- 19 Air inlet housing for Schnorchel
- 20 Trunking to Schnorchel
- 21 Starboard saddle-tank
- 22 Main ballast pump
- 23 Air filter
- 24 Lightening hole in main diving tank transverse bulkhead



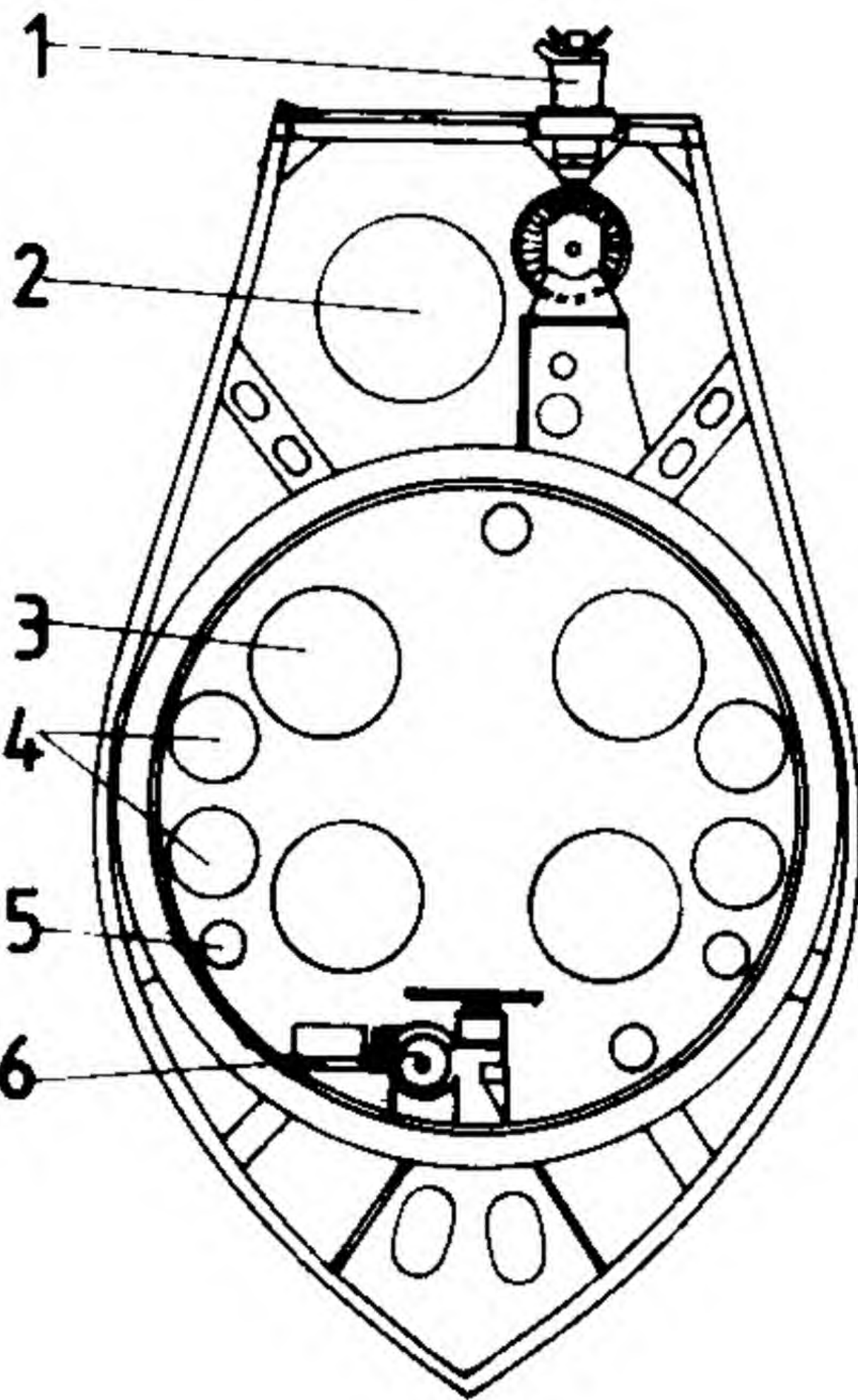
- C7 SECTION AT RADIO ROOM**
- 1 Schnorchel mast
 - 2 Captain's cabin
 - 3 Starboard saddle-tank
 - 4 Radio room
 - 5 Hatch to control room
 - 6 Gangway
 - 7 Main fuel tank III
 - 8 Magazine
 - 9 Keel

C Hull sections

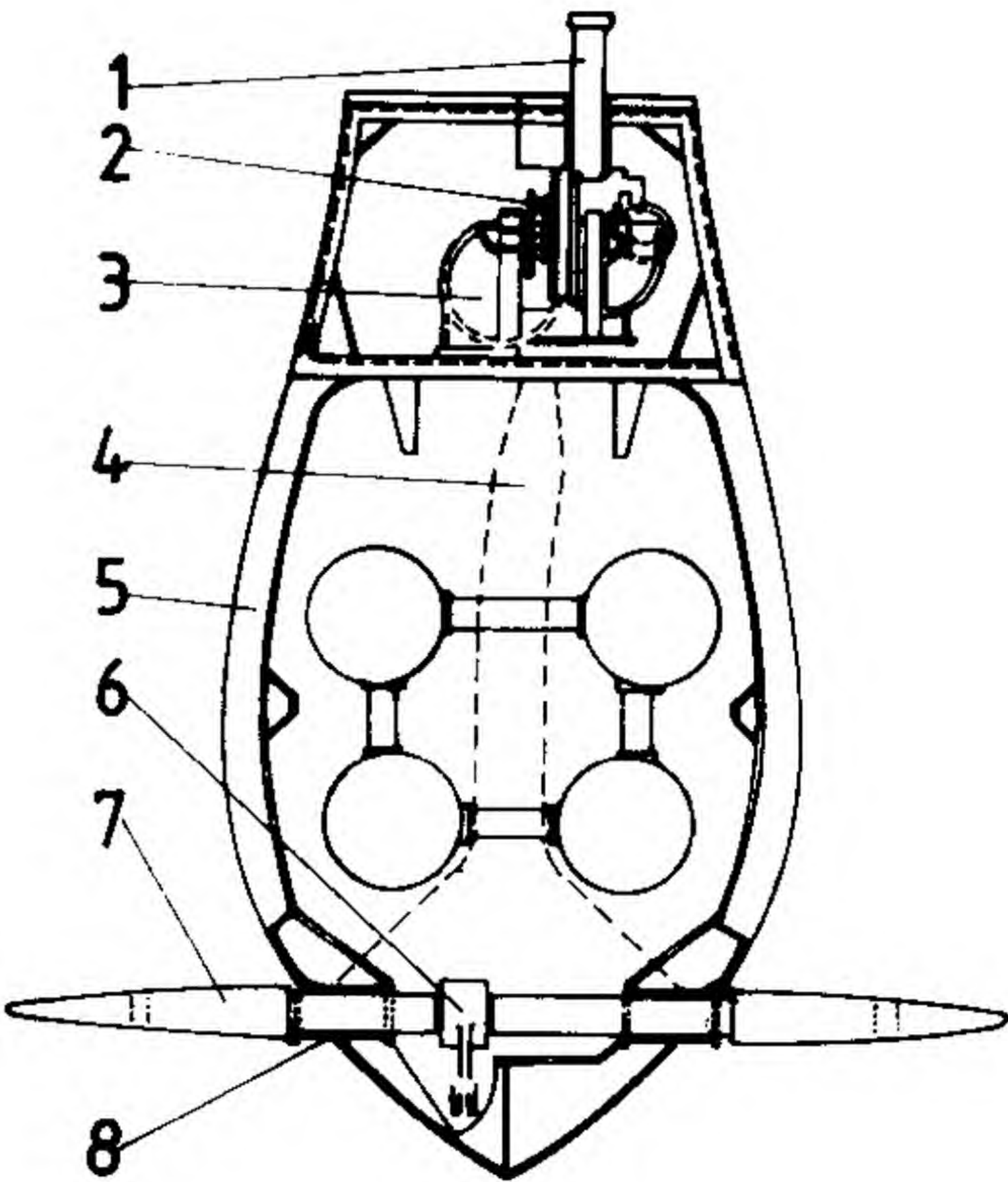
C8



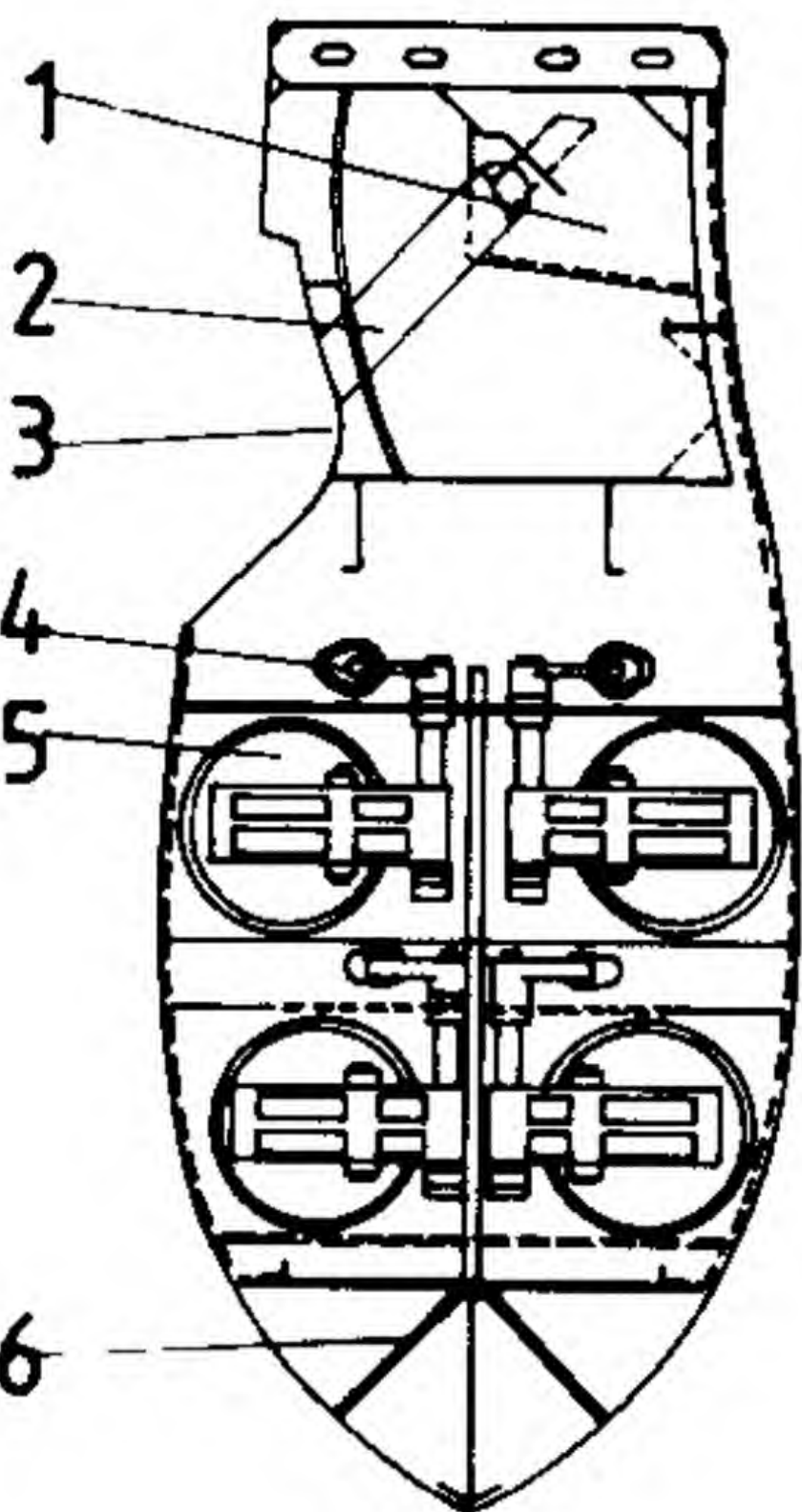
C9



C10



C11



- C8
- SECTION AT FORWARD TORPEDO ROOM
- 1

Reserve torpedo container
- 2

Forward torpedo loading hatch
- 3

Access door to officers' and senior ratings' quarters
- 4

Forward torpedo room mess
- 5

High pressure air bottles group 5
- 6

Reserve torpedo stowage locations
- 7

Torpedo compensating tank
- 8

Bilge casing
- 9

Keel

- C9
- SECTION AT CAPSTAN
- 1

Capstan
- 2

Forward reserve torpedo container
- 3

Torpedo tube I
- 4

High pressure air bottles for torpedo tubes I and III
- 5

High pressure airline
- 6

Forward hydroplane control motor

- C10
- SECTION AT FORWARD HYDROPLANES
- 1

Bollard
- 2

Anchor windlass
- 3

Forward torpedo container
- 4

Main stem post
- 5

Outer casing
- 6

Hydroplane link
- 7

Starboard hydroplane blade
- 8

Hydroplane gland and seal

- C11
- SECTION AT BOW TORPEDO TUBE DOORS
- 1

Deck stores stowage space
- 2

Anchor sleeve
- 3

Outer casing
- 4

Control arm for torpedo tube I door
- 5

Door to torpedo tube I
- 6

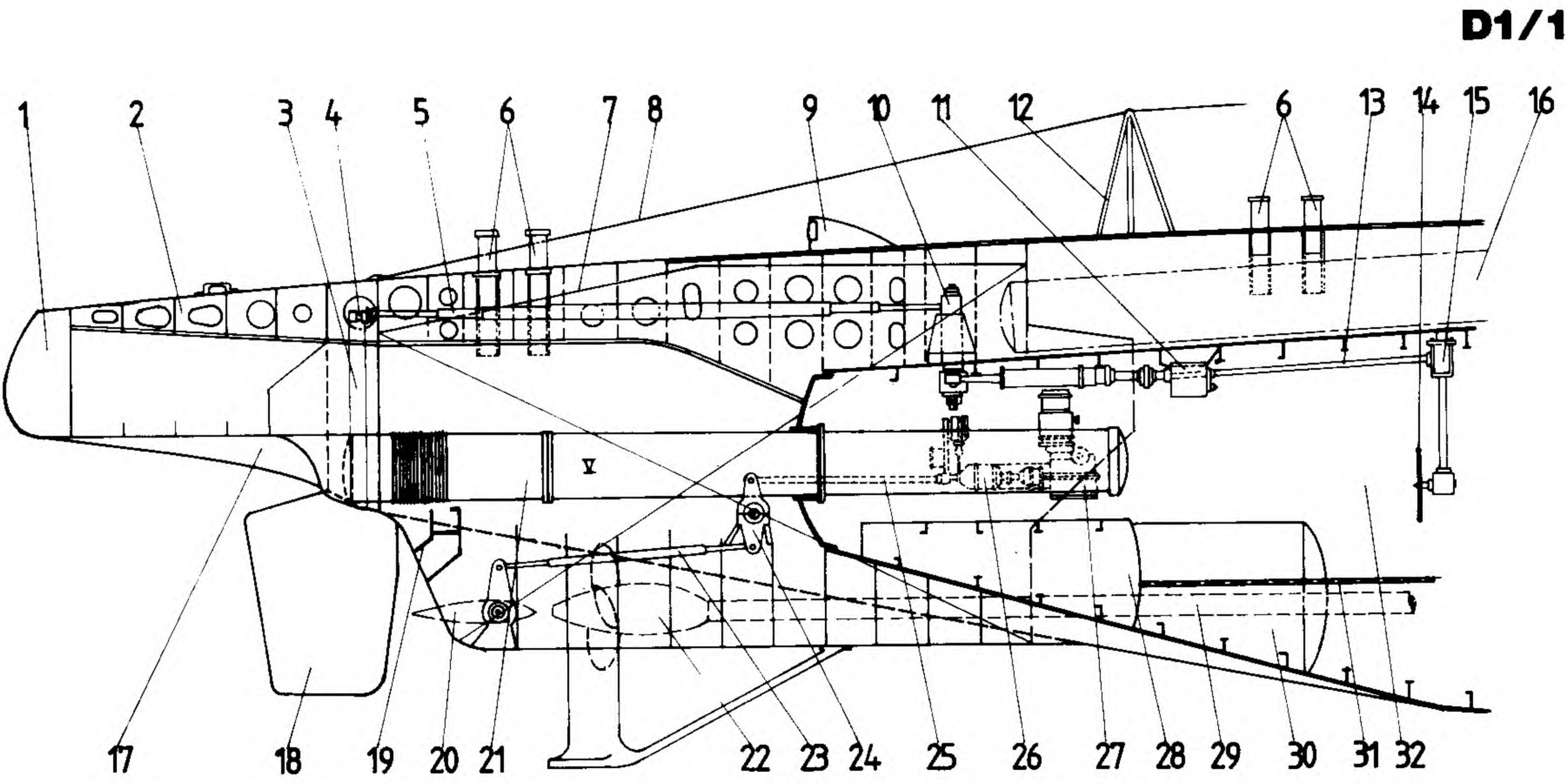
Bow fairing plate

D Compartments

D COMPARTMENTS, TYPE VIIC
(unless otherwise noted, all
drawings in this section are to 1/100
scale)

D1/1 STERN, INTERNAL PROFILE
(showing steering controls)

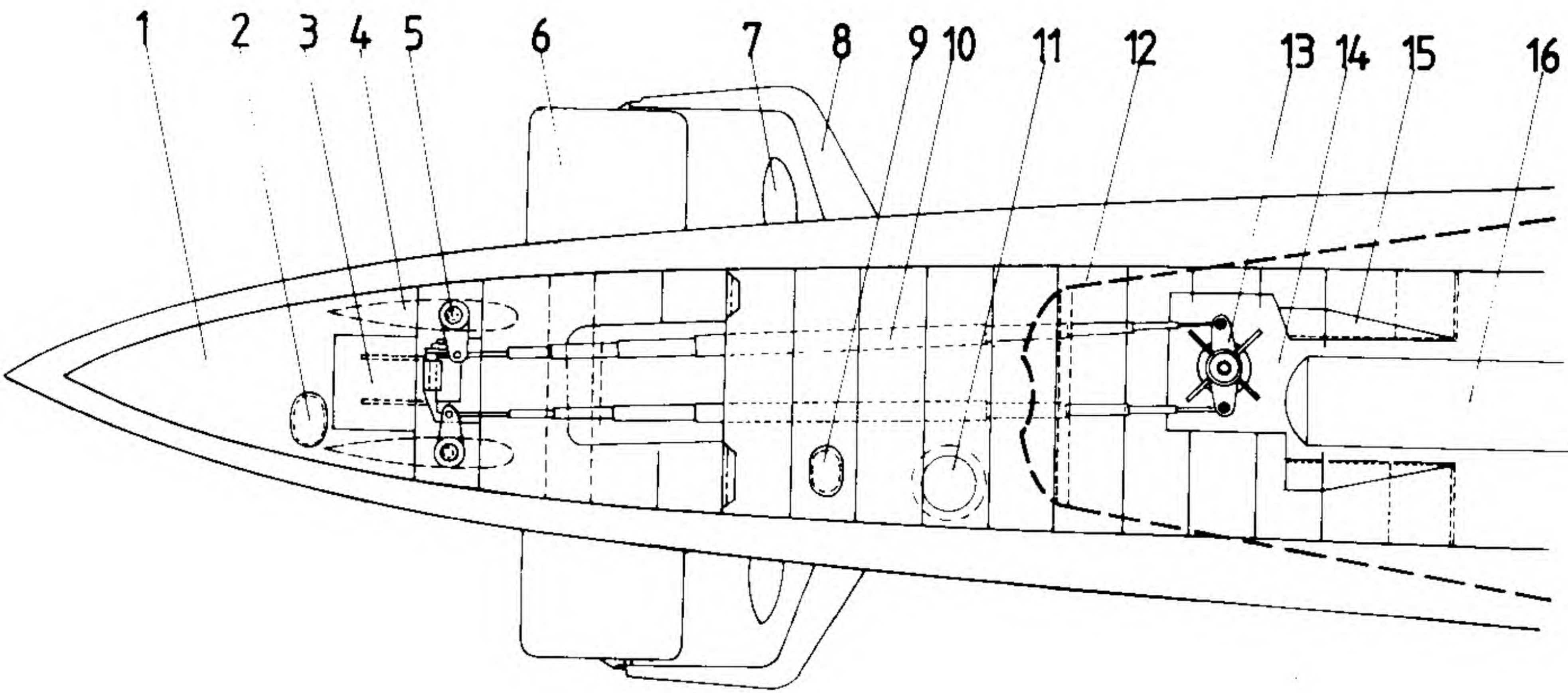
- 1 Stern casing
- 2 Stringer III
- 3 Rudder post
- 4 Rudder post universal joint
- 5 Rudder linkage
- 6 Bollards
- 7 Upper casing of diving tank 1
- 8 Aerial/jumping wire
- 9 Stern navigation light
- 10 Rudder control linkage
- 11 Rudder control motor
- 12 Fixed deck rails
- 13 Rudder transmission arm
- 14 Emergency wheel
- 15 Gear box
- 16 Reserve torpedo container
- 17 Stern torpedo outlet
- 18 Rudder
- 19 Stern torpedo tube support arm
- 20 Hydroplane
- 21 Stern torpedo tube
- 22 Propeller boss
- 23 Hydroplane control arm
- 24 Hydroplane control linkage
- 25 Hydroplane control arm
- 26 Hydroplane control piston
- 27 Hydroplane control motor
- 28 Stern trim tank
- 29 Propeller shaft
- 30 Torpedo compensating tank
- 31 Deck
- 32 Stern torpedo room and motor room



D Compartments

D1/2 STERN, PLAN BELOW OUTER CASING LEVEL

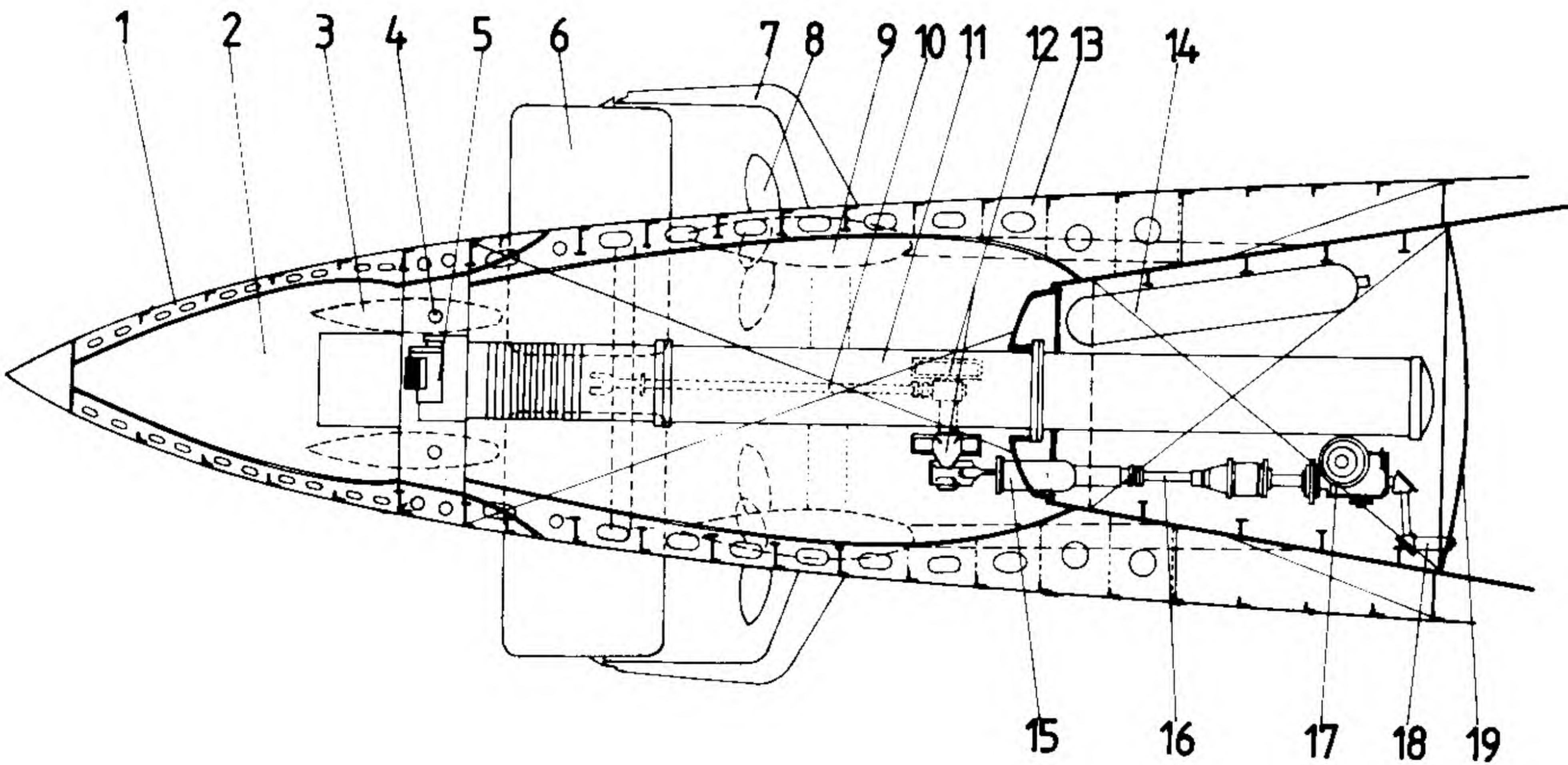
- 1 Stern casing
- 2 Outlet valve for diving tank 1
- 3 Support plate for stern casing
- 4 Port rudder
- 5 Port rudder post
- 6 Port hydroplane
- 7 Port propeller
- 8 Port hydroplane fairing
- 9 Outlet valve for diving tank 1 (below)
- 10 Rudder control arm
- 11 Inlet valve for diving tank 1 (below)
- 12 Pressure hull line
- 13 Rudder control housing and gland
- 14 Rudder control access space
- 15 Forward point of stern casing
- 16 Reserve torpedo container (watertight)



D1/2

D1/3 STERN, PLAN AT WORKING DECK LEVEL

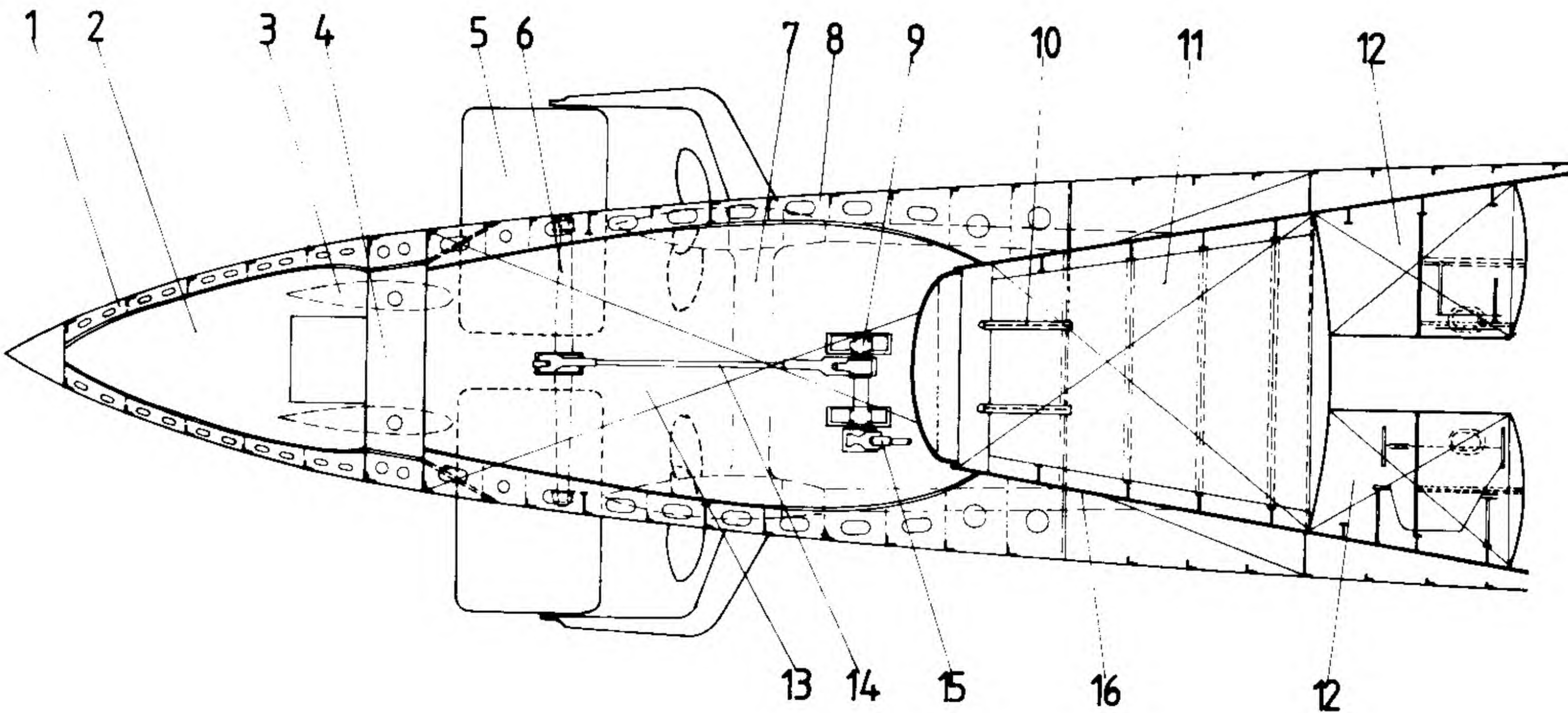
- 1 Stringer III
- 2 Free-flooding stern
- 3 Port rudder
- 4 Port rudder post
- 5 Stern torpedo door hinge
- 6 Port hydroplane
- 7 Port hydroplane fairing
- 8 Port propeller
- 9 Port propeller hub
- 10 Hydroplane control linkage
- 11 Stern torpedo tube
- 12 Hydroplane control gears
- 13 Stringer II
- 14 High pressure air bottle
- 15 Hydroplane control piston
- 16 Hydroplane control arm
- 17 Hydroplane control motor
- 18 Hydroplane control linkage to control room (hydraulic/manual)
- 19 Forward line of stern trim tank



D1/3

D1/4 STERN, PLAN AT HYDROPLANE LEVEL

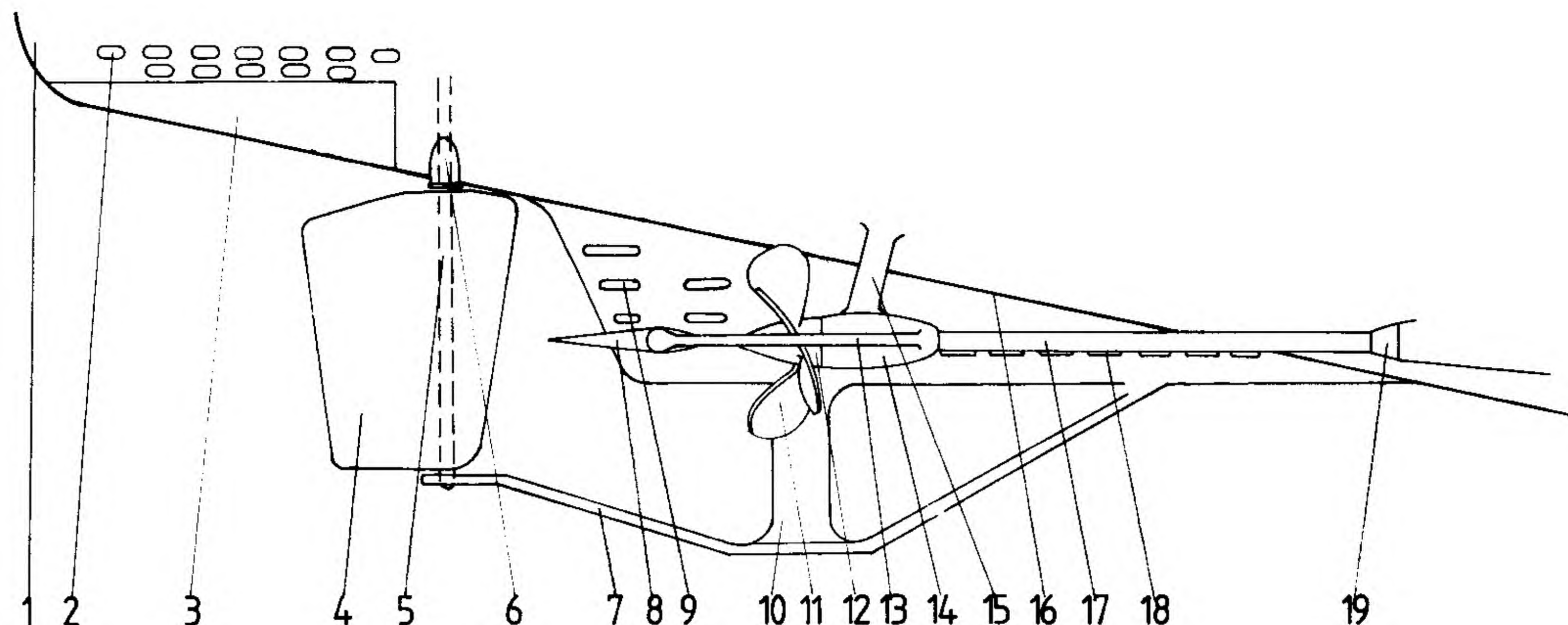
- 1 Stringer III
- 2 Free-flooding stern
- 3 Port rudder
- 4 Rudder beam
- 5 Port hydroplane
- 6 Port hydroplane arm
- 7 Horizontal support beam
- 8 Stringer II
- 9 Hydroplane attitude control motor
- 10 Support beam of stern trim tank
- 11 Stern trim tank
- 12 Torpedo compensating tanks
- 13 Diving tank 1
- 14 Hydroplane attitude drive arm
- 15 Hydroplane motor linkage
- 16 Pressure hull



D1/4

**D1/5 STERN GENERAL
ARRANGEMENTS, TYPE VIIC/41
(similar to the early design, but with
more effective arrangement of the
hydroplanes, rudders and the
propeller housings)**

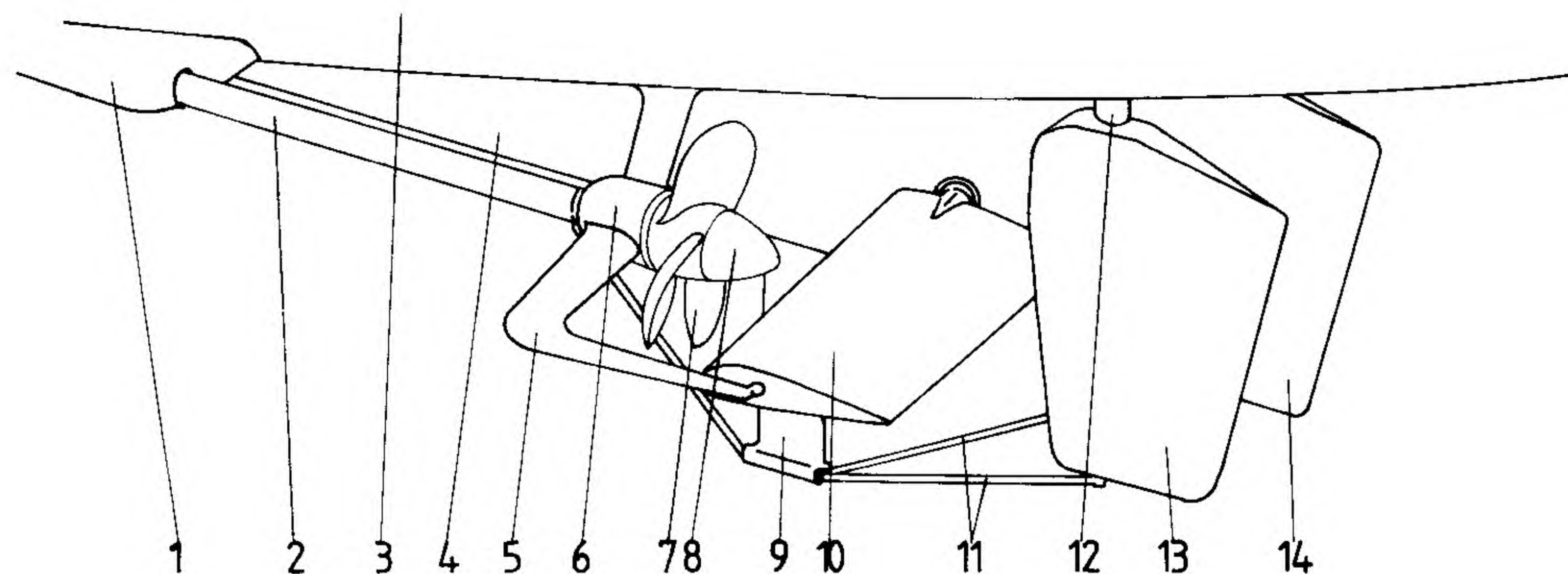
- 1 Stern casing
- 2 Stern casing drainage slots
- 3 Stern torpedo tube outer door
(closed)
- 4 Starboard rudder
- 5 Starboard rudder post
- 6 Starboard rudder post gland and
seal
- 7 Starboard rudder support arm
- 8 Starboard aft hydroplane
- 9 Keel casing drainage slots
- 10 Stern post
- 11 Propeller blade (3-bladed
propellers port and starboard)
- 12 Propeller hub
- 13 Hydroplane support extension arm
- 14 Propeller housing
- 15 Propeller housing support arm
- 16 Line of stern outer casing
- 17 Propeller shaft
- 18 Keel casing drainage slots
- 19 Propeller watertight housing and
gland



D1/5

**D1/6 GENERAL VIEW OF
PROPELLERS AND RUDDERS
COMMON TO ALL TYPE VII
BOATS (no scale)**

- 1 Propeller shaft housing and
watertight gland
- 2 Propeller shaft
- 3 Aft casing
- 4 Keel casing extension
- 5 Hydroplane support extension arm
- 6 Propeller housing
- 7 Propeller blade (3-bladed
propeller)
- 8 Propeller hub
- 9 Stern post
- 10 Port hydroplane
- 11 Rudder supports
- 12 Port rudder control extension arm
- 13 Port rudder
- 14 Starboard rudder



D1/6

D Compartments

- D2/1
- MOTOR ROOM AND STERN TORPEDO COMPARTMENT, INTERNAL PROFILE
- 1

Rudder control arm
- 2

Knee beam
- 3

Rudder linkage post
- 4

High pressure air group 1
- 5

Steering control gearing
- 6

Battery status panel
- 7

Exhaust silencer
- 8

Main electrical control panel
- 9

Stern torpedo loading hatch
- 10

Bulkhead door to engine room
- 11

Hydroplane control linkage
- 12

Pressure hull
- 13

Stern trim tank
- 14

Hydroplane control motor
- 15

Hydroplane hydraulic servo motor
- 16

Torpedo compensating tank
- 17

Propeller shaft
- 18

Auxiliary pump
- 19

Deck
- 20

Shaft tunnel
- 21

Shaft gland support
- 22

Shaft gland (self-oiling)
- 23

Main reduction gear box and clutch
- 24

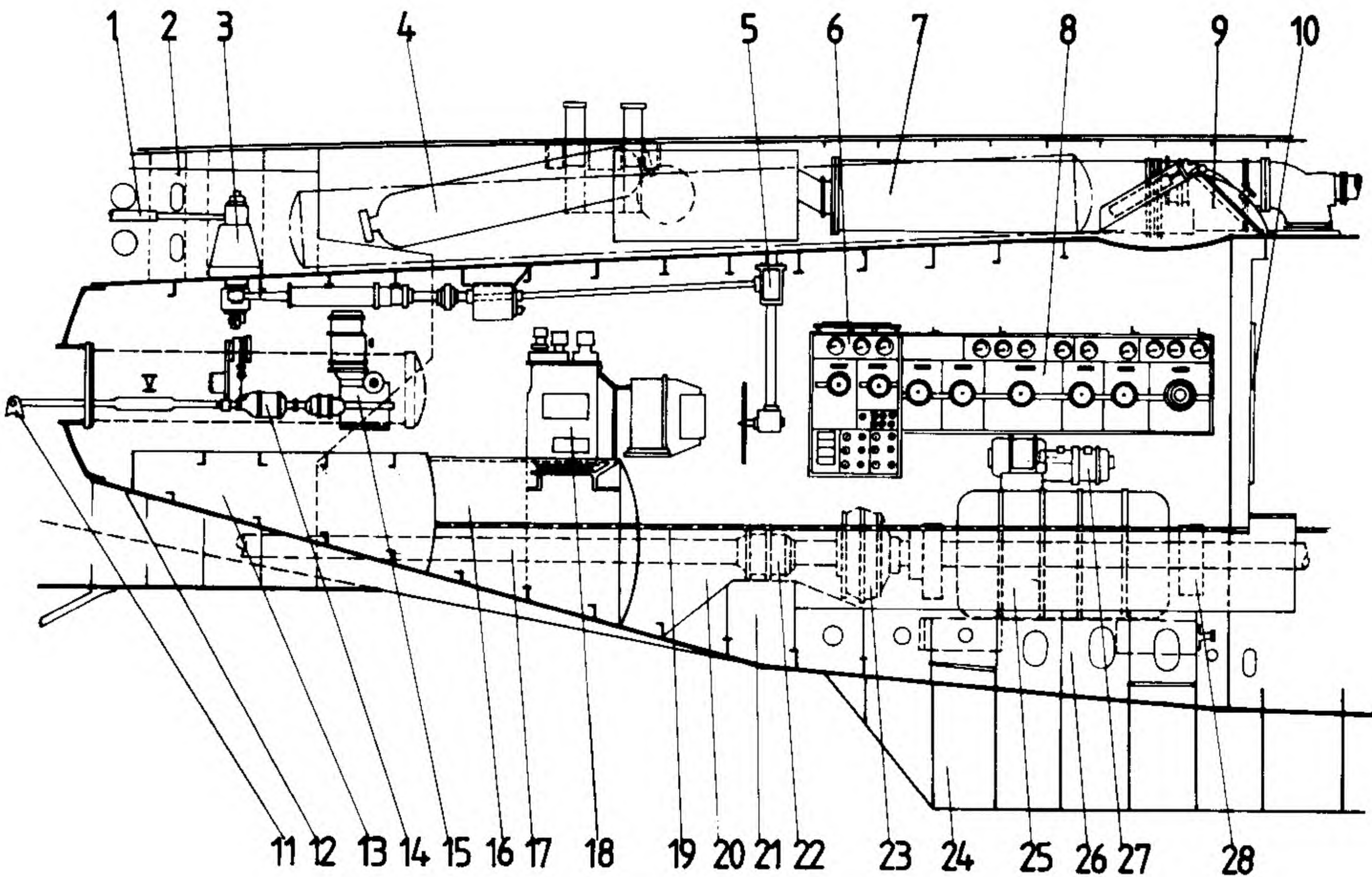
Keel
- 25

Main electric motor
- 26

Electric motor support
- 27

Auxiliary generator
- 28

Oiler



D2/1

- D2/2
- MOTOR ROOM AND STERN TORPEDO ROOM, PLAN BENEATH CASING DECK
- 1

Rudder control arm
- 2

Rudder control post
- 3

Rudder control mounting plate
- 4

Outline of pressure hull
- 5

Line of outer casing
- 6

High pressure air bottle
- 7

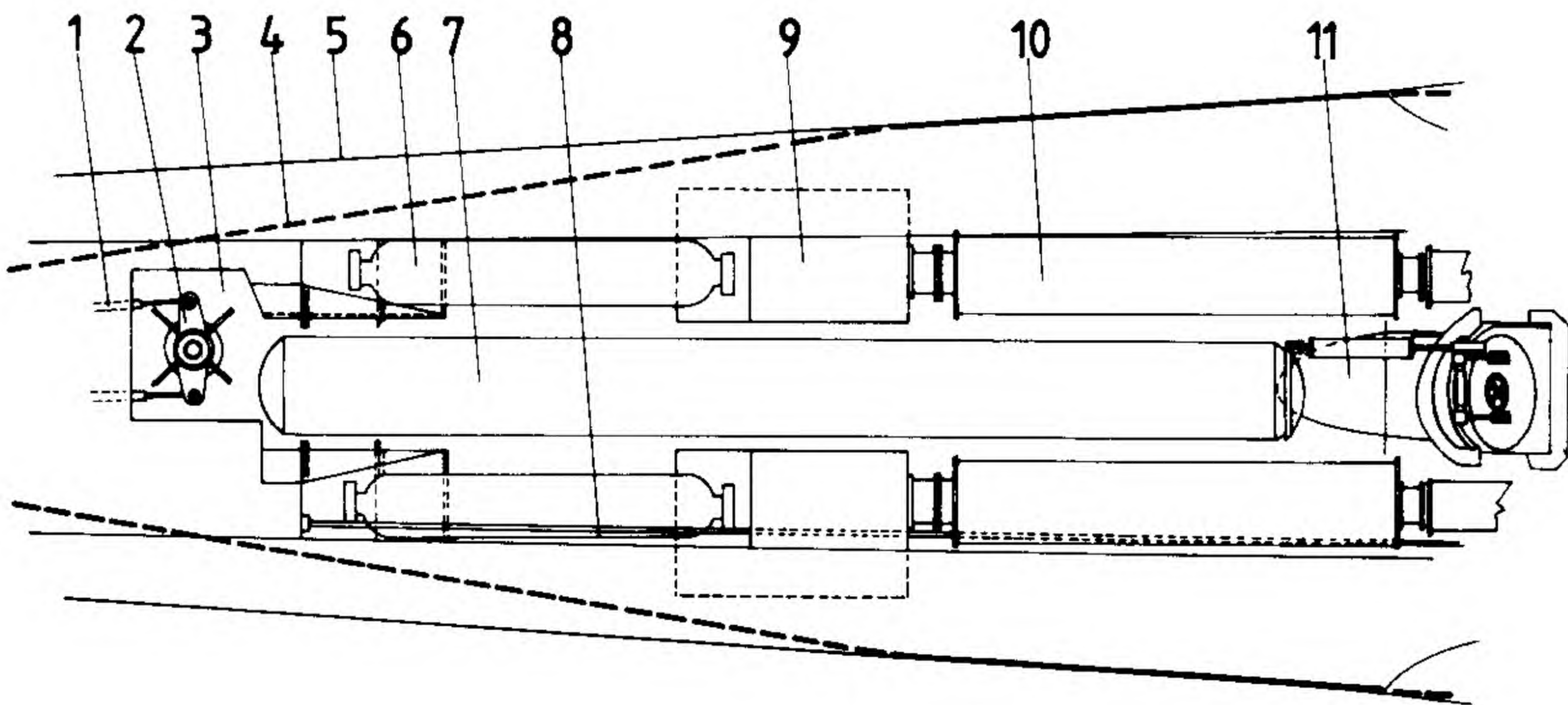
Stern reserve torpedo container
- 8

High pressure air line to stern diving tank
- 9

Exhaust housing
- 10

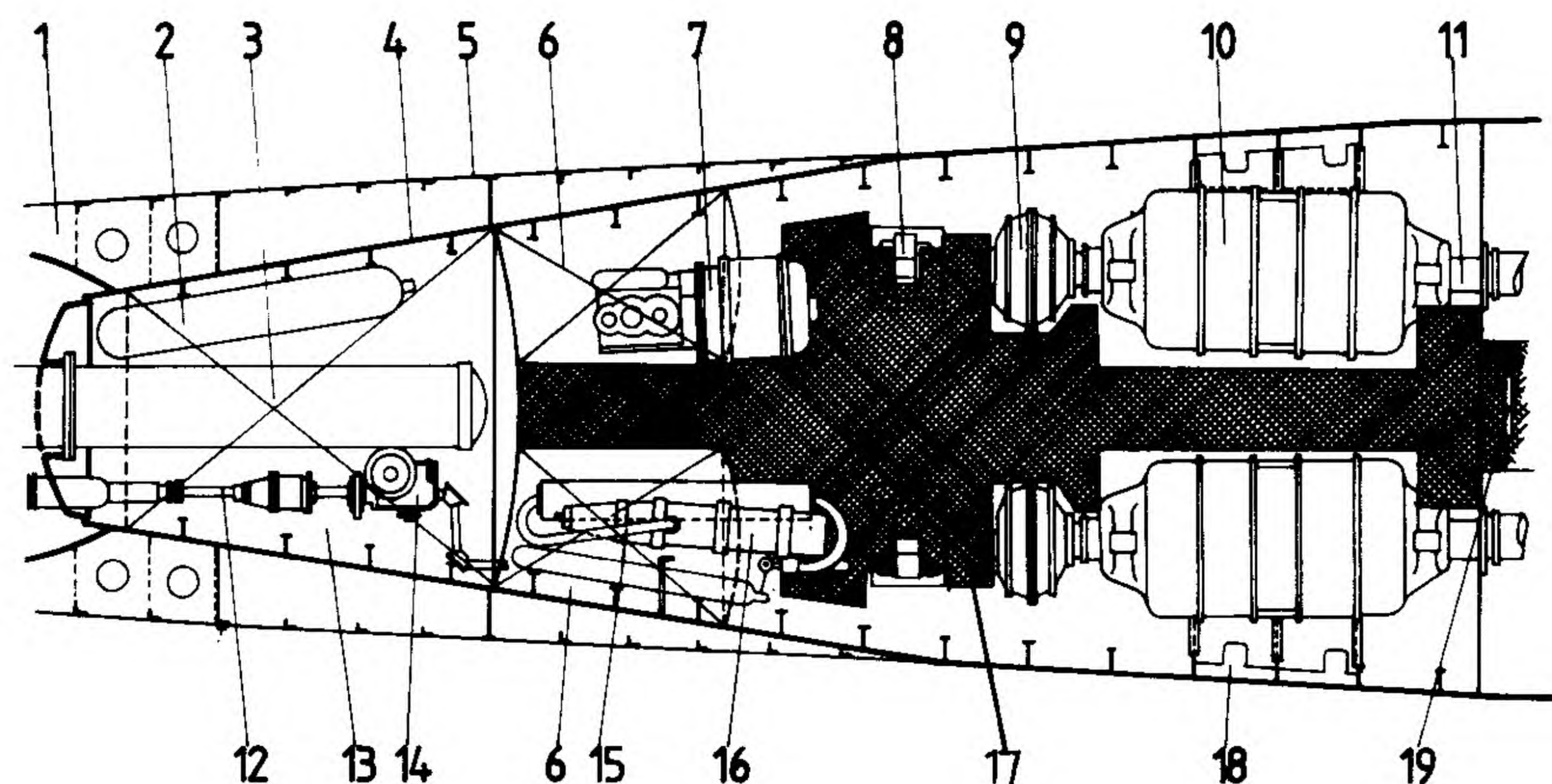
Exhaust silencer
- 11

Stern torpedo loading hatch



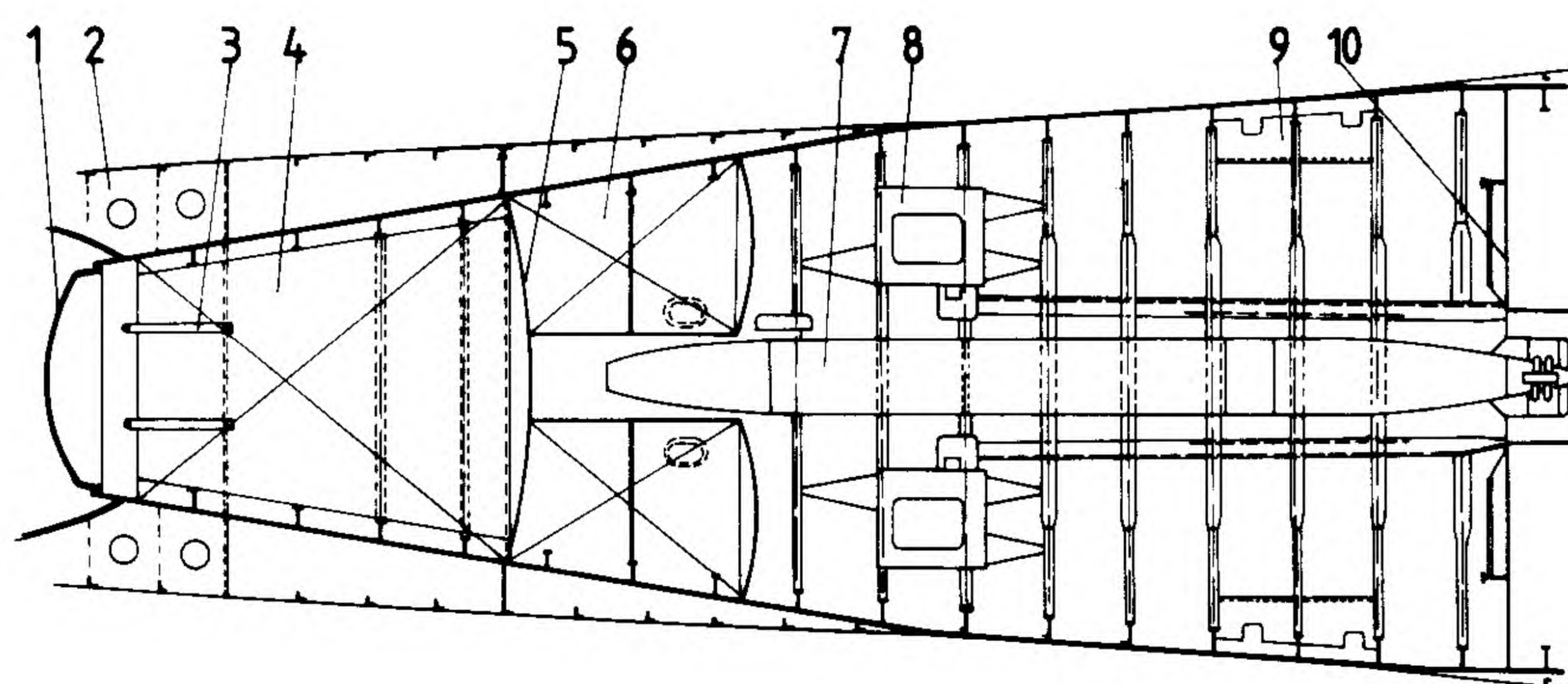
D2/2

- D2/3 MOTOR ROOM AND STERN TORPEDO ROOM, PLAN AT DECK LEVEL**
- 1 Stringer II
 - 2 High pressure air supply for stern torpedo tube
 - 3 Stern torpedo tube (number V)
 - 4 Pressure hull
 - 5 Outer casing
 - 6 Stern torpedo compensating tank (port and starboard)
 - 7 Auxiliary generator
 - 8 Oiling gland for propeller shaft
 - 9 Clutch
 - 10 Main electric motor
 - 11 Drive shaft
 - 12 Stern hydroplane control arm
 - 13 Stern trim tank
 - 14 Stern hydroplane hydraulic servo motor
 - 15 Junkers air compressor feed hose to high pressure air reservoir
 - 16 Junkers air compressor
 - 17 Non-slip deck
 - 18 Motor support mounting
 - 19 Bulkhead door to engine room



D2/3

- D2/4 MOTOR ROOM AND STERN TORPEDO ROOM, PLAN AT HOLD LEVEL**
- 1 Pressure hull stern cap
 - 2 Stringer II
 - 3 Support beam
 - 4 Aft diving tank
 - 5 Bulkhead for diving tank
 - 6 Torpedo compensating tank (port and starboard)
 - 7 Reserve torpedo (one)
 - 8 Deck support mountings
 - 9 Motor support mounting
 - 10 Motor/engine room bulkhead

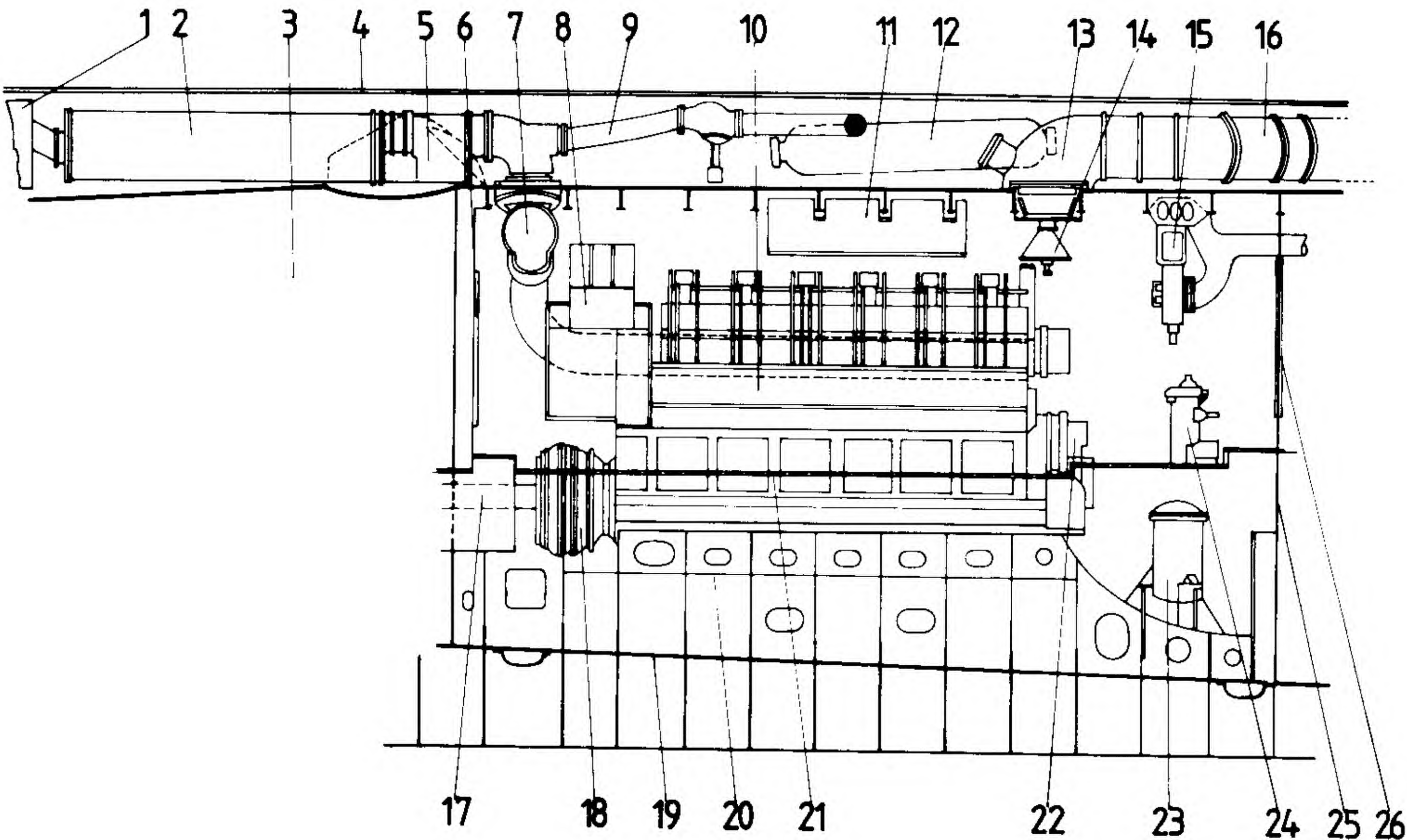


D2/4

D Compartments

D3/1 ENGINE ROOM, INTERNAL PROFILE (showing exhaust system)

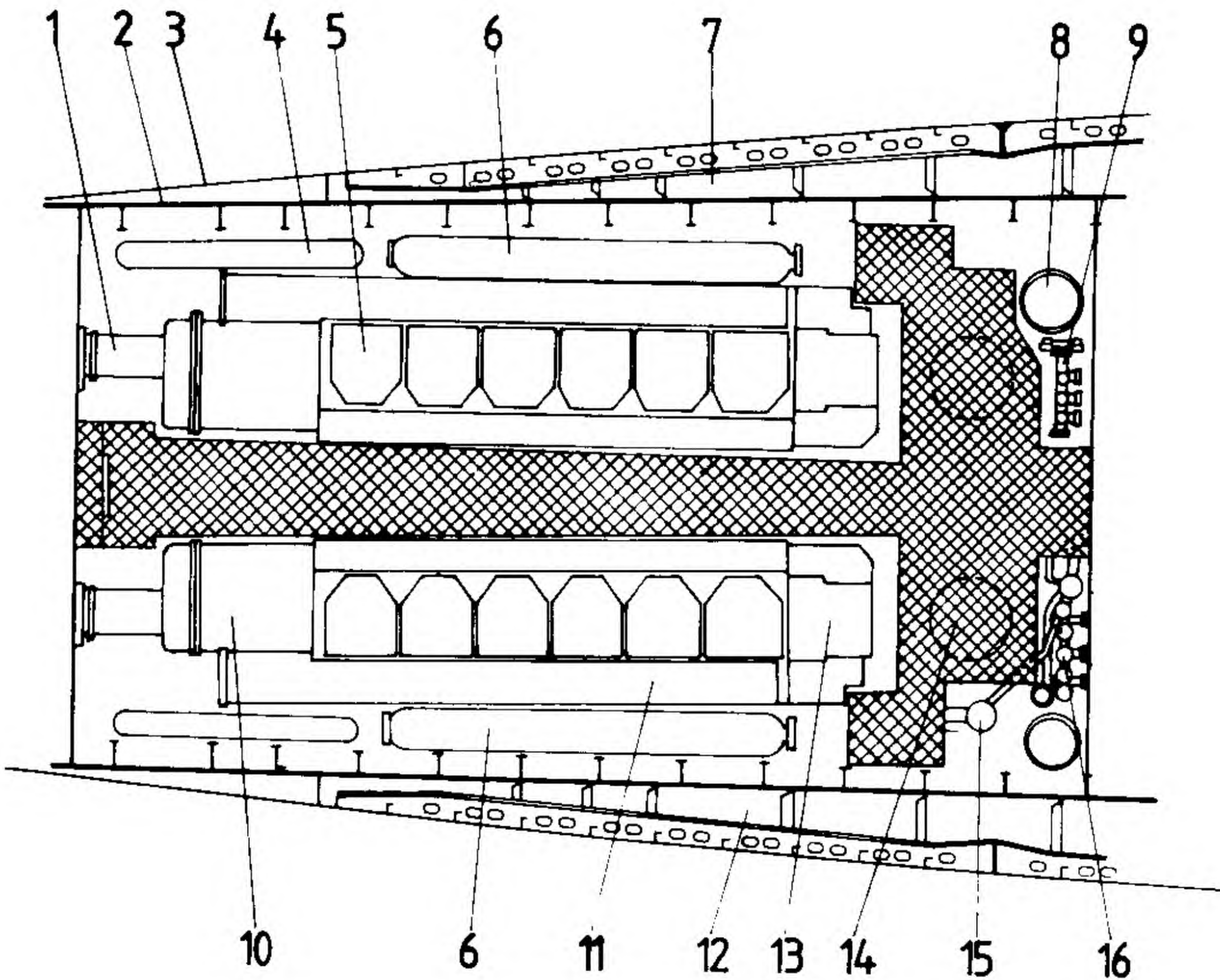
- 1 Diesel exhaust box
- 2 Diesel exhaust silencer
- 3 Motor room
- 4 Deck casing
- 5 Aft torpedo loading hatch
- 6 Diesel room/motor room connecting door
- 7 Diesel exhaust coupling
- 8 Electric control panel
- 9 Forward diesel exhaust (leading to Schnorchel)
- 10 Port diesel engine
- 11 Cooling water header tank
- 12 High pressure air bottle
- 13 Air inlet to diesel room (from normal air trunking abaft the bridge and from Schnorchel)
- 14 Air inlet control valve
- 15 Air inlet bleeder valve
- 16 Air inlet trunking
- 17 Propeller shaft
- 18 Clutch
- 19 Pressure hull
- 20 Engine mounting
- 21 Deck
- 22 Diesel air pressure starter
- 23 Fuel oil cooler/filter
- 24 Fuel oil feed
- 25 Bulkhead
- 26 Bulkhead door



D3/1

D3/2 ENGINE ROOM, PLAN AT WORKING DECK

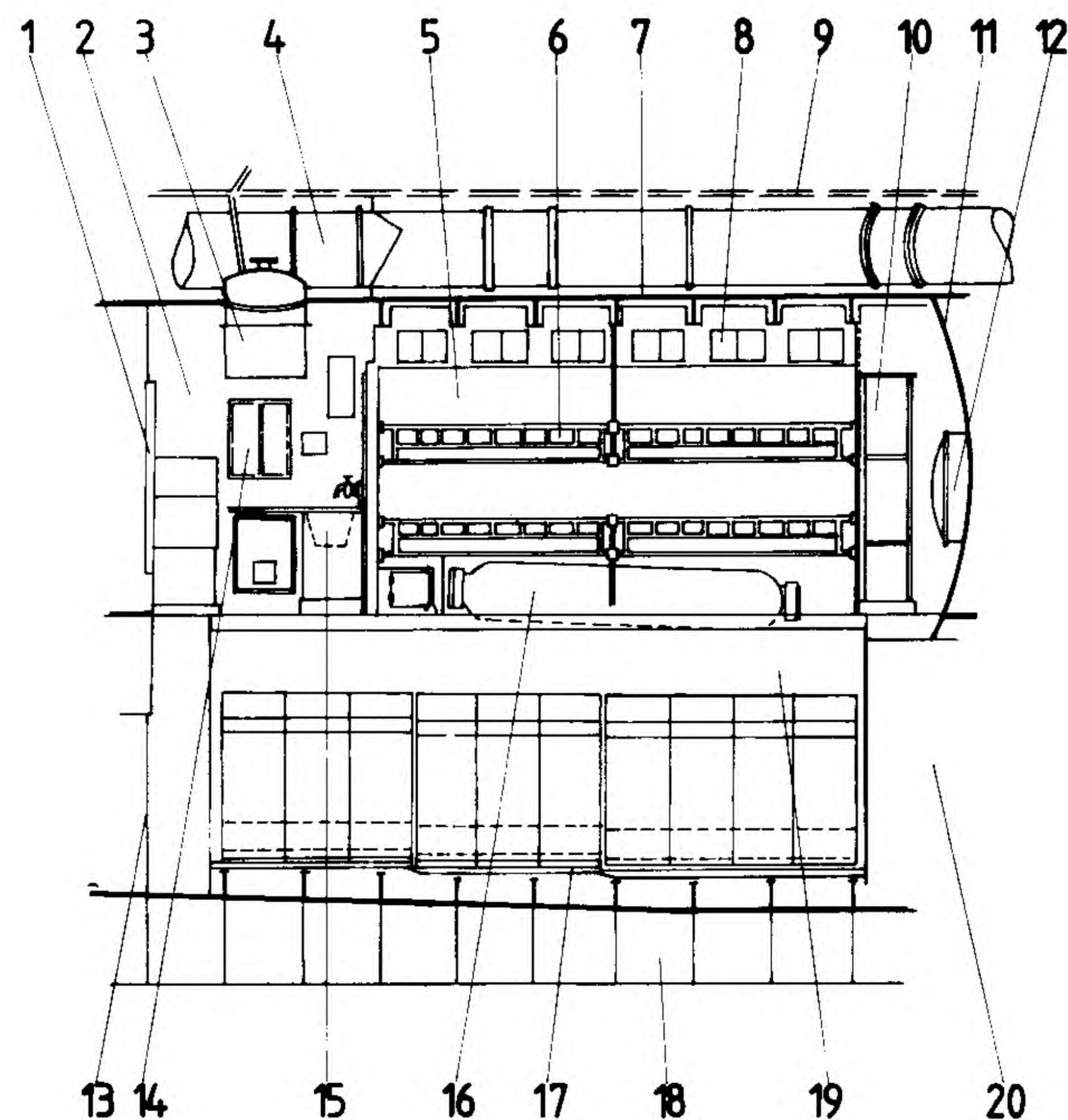
- 1 Starboard propeller shaft housing
- 2 Pressure hull
- 3 Outer casing of saddle-tank
- 4 High pressure oxygen bottle
- 5 Diesel cylinder head and fuel injector assembly
- 6 High pressure air supply to starboard diesel engine starter
- 7 Saddle-tank diving tank 2 (port and starboard)
- 8 Oil fuel pump
- 9 Slave oil fuel pump controls and valves for starboard engine
- 10 Rear engine housing and clutch
- 11 Exhaust
- 12 Port saddle-tank (and see 7)
- 13 Engine starter (compressed air operated)
- 14 Oil cooler
- 15 Main oil fuel inlet control valve
- 16 Master oil fuel control valves



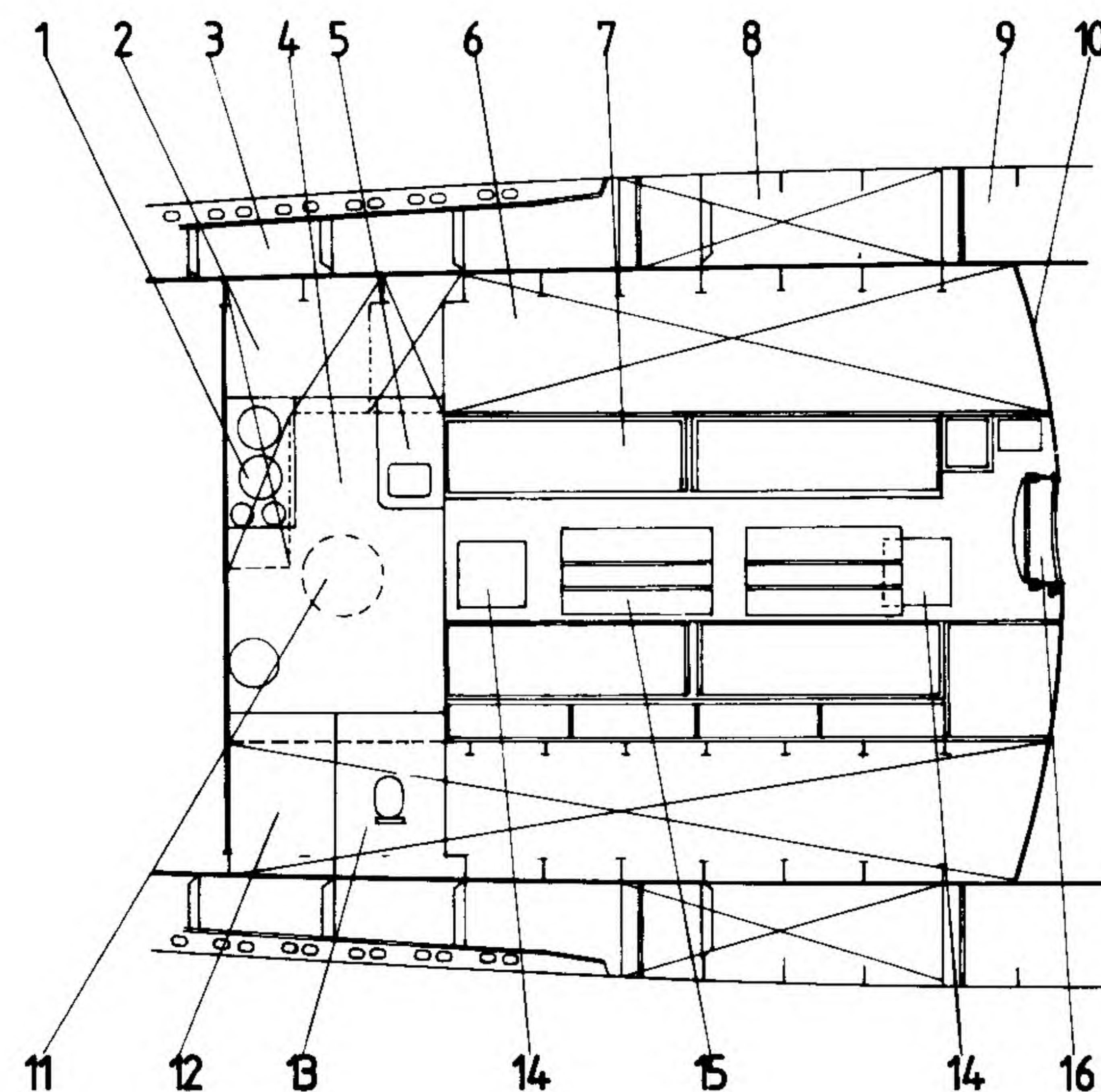
D3/2

D4/1 ENGINEERS' AND SENIOR RATES' MESS, LONGITUDINAL SECTION

- 1 Hatch to diesel engine room
- 2 Galley
- 3 Galley escape hatch
- 4 Main diesel air inlet trunking
- 5 Engineers' and senior rates' mess
- 6 Bunk
- 7 Pressure hull
- 8 Locker
- 9 Outer casing (line of)
- 10 Wardrobe
- 11 Aft bulkhead of control room
- 12 Pressure-tight hatch
- 13 Bulkhead
- 14 Food store
- 15 Sink
- 16 High pressure air group
- 17 Shock-proof flooring
- 18 Keel
- 19 Battery room I
- 20 Main fuel bunker li



D4/1



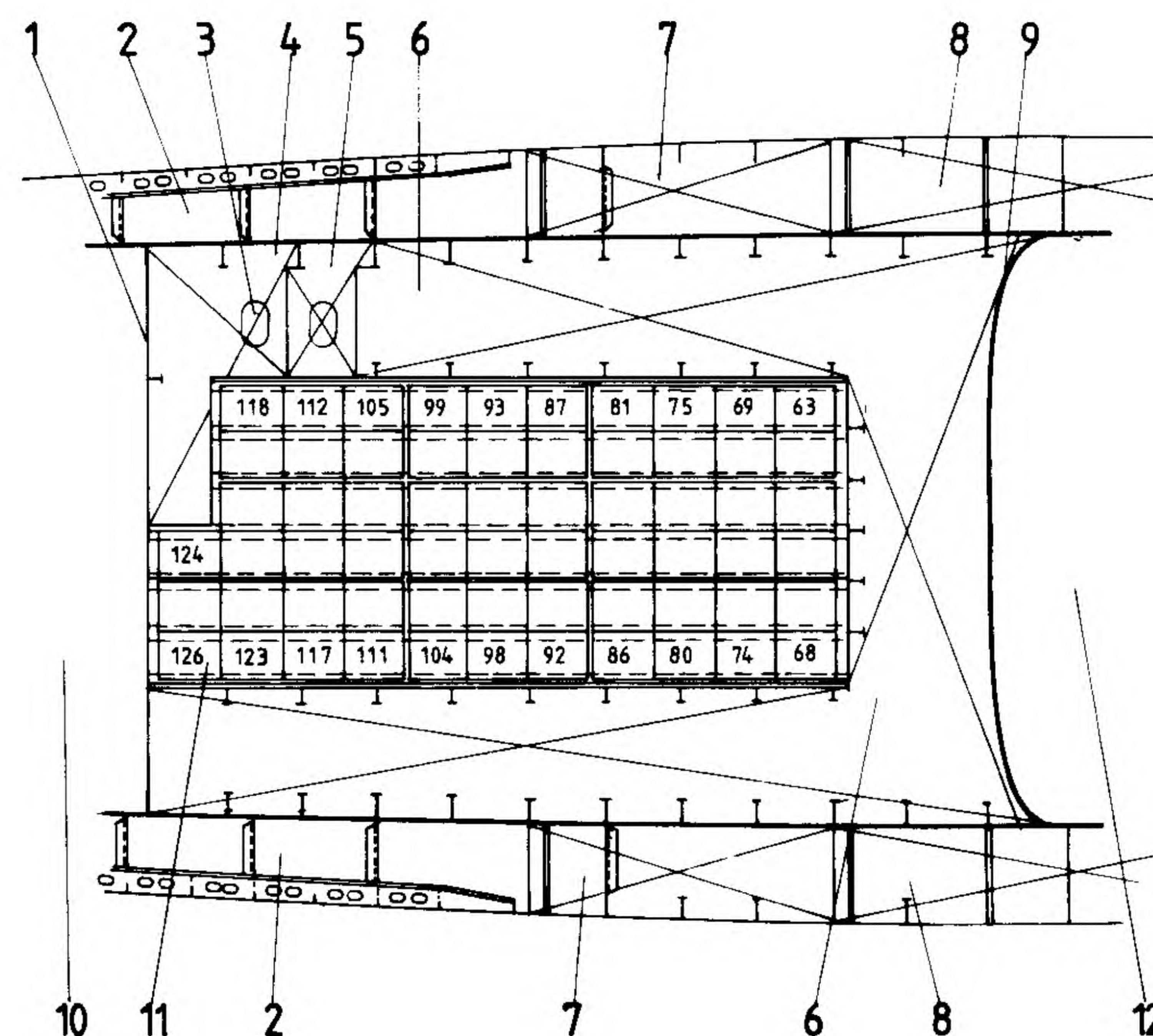
D4/2

D4/2 ENGINEERS' AND SENIOR RATES' MESS, PLAN AT WORKING DECK LEVEL

- 1 Stove
- 2 Food stores
- 3 Saddle-tank diving tank 2
- 4 Galley
- 5 Sink
- 6 Fuel oil bunker li
- 7 Bunks (2 x 1)
- 8 Regulating tank 1
- 9 Regulating tank 2
- 10 Forward bulkhead
- 11 Escape/access hatch outline
- 12 Battery switching room I
- 13 Heads
- 14 Access hatches to battery compartment (below)
- 15 Folding mess tables
- 16 Watertight hatch through bulkhead

D4/3 ENGINEERS' AND SENIOR RATES' MESS, PLAN BELOW WORKING DECK LEVEL (battery room I)

- 1 Bulkhead between battery room I and engine room bilge
- 2 Ballast tank 2 (port and starboard)
- 3 Vent for fresh water tank
- 4 Fresh water tank 1
- 5 Dirty water collection tank 1
- 6 Main oil fuel tank li
- 7 Regulating tank 1 (port and starboard)
- 8 Regulating tank 2 (port and starboard)
- 9 Pressure bulkhead of main diving tank
- 10 Engine room bilge
- 11 Battery cells of battery room I
- 12 Main diving tank



D4/3

D Compartments

- D5/1
- CONTROL ROOM AND TOWER, LONGITUDINAL SECTION
- 1

Diesel air inlet mast (surface running)
- 2

Boat air inlet mast (surface running)
- 3

Collision reinforcement
- 4

Attack periscope outer housing
- 5

Attack periscope stem
- 6

Tower access/escape hatch
- 7

Control room/air search periscope
- 8

Pressure hull
- 9

Torpedo firing order instruments
- 10

Main diving tank pump
- 11

Fuse box
- 12

Watertight hatch in aft bulkhead (leading to engineers' quarters)
- 13

Auxiliary pump controls
- 14

By-pass valve for main diving tank
- 15

Main oil fuel tank li
- 16

Main diving tank frame
- 17

Keel
- 18

Kirek torpedo firing lever
- 19

Nightsight heater
- 20

Revolution repeater (propeller shaft speed)
- 21

Compass repeater
- 22

Torpedo director
- 23

Casing outline
- 24

Access hatch to tower
- 25

Control room periscope gland
- 26

Firing system switches
- 27

Firing system fuses
- 28

Automatic salvo switch
- 29

Forward watertight hatch (leading to forward part of boat)
- 30

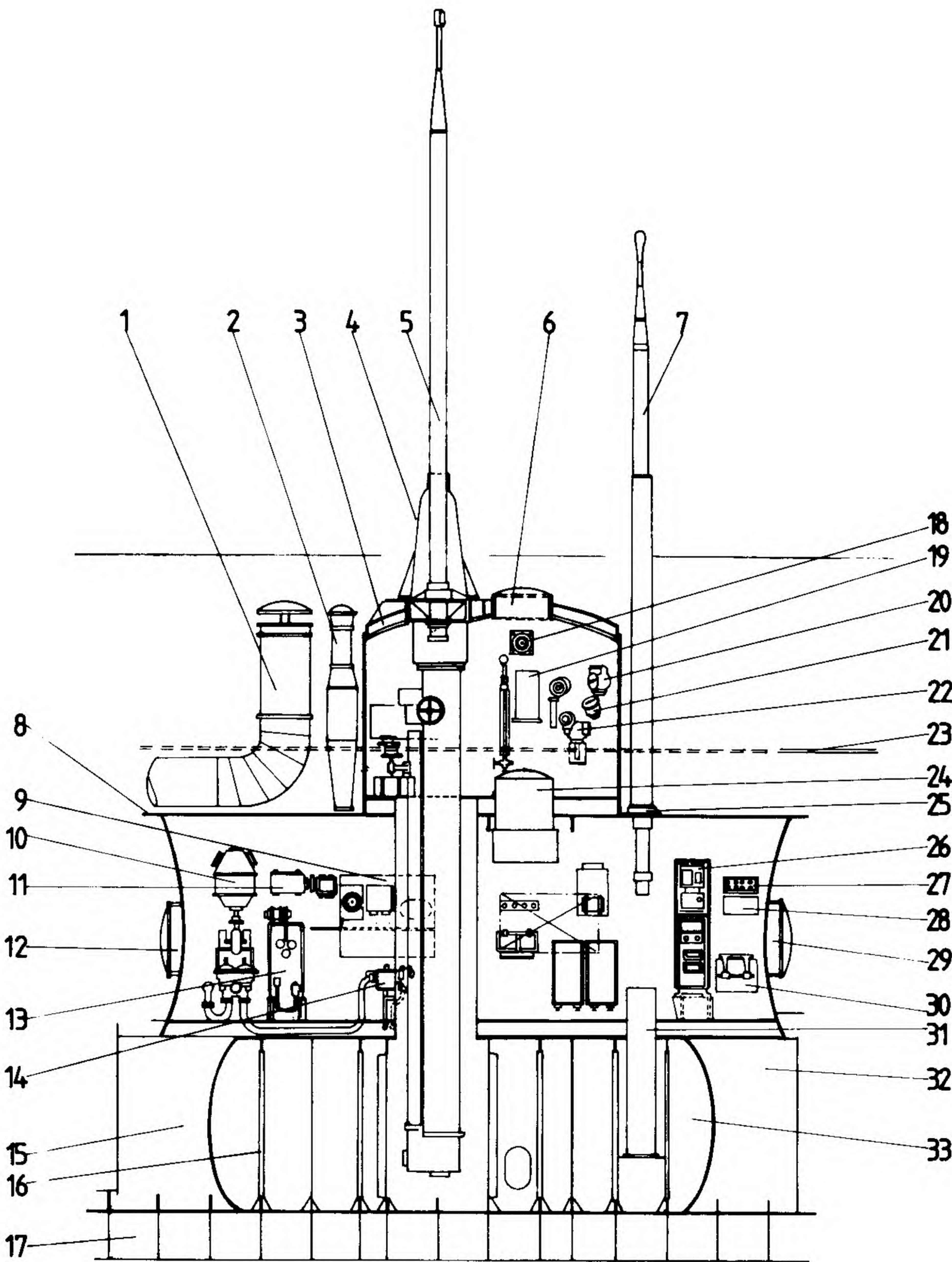
Main fuse box
- 31

Air search periscope well
- 32

Main oil fuel tank lli
- 33

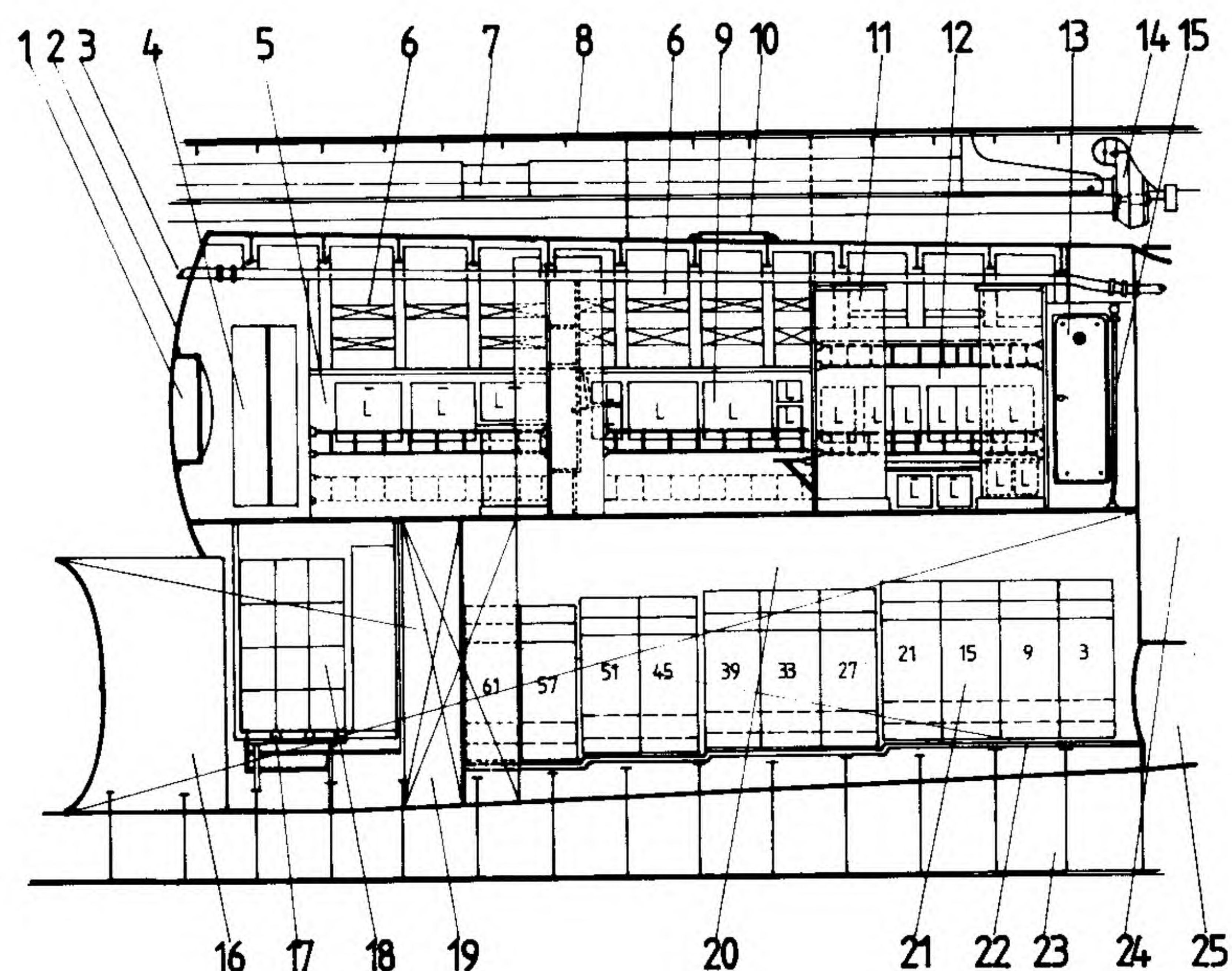
Main diving tank

D5/1



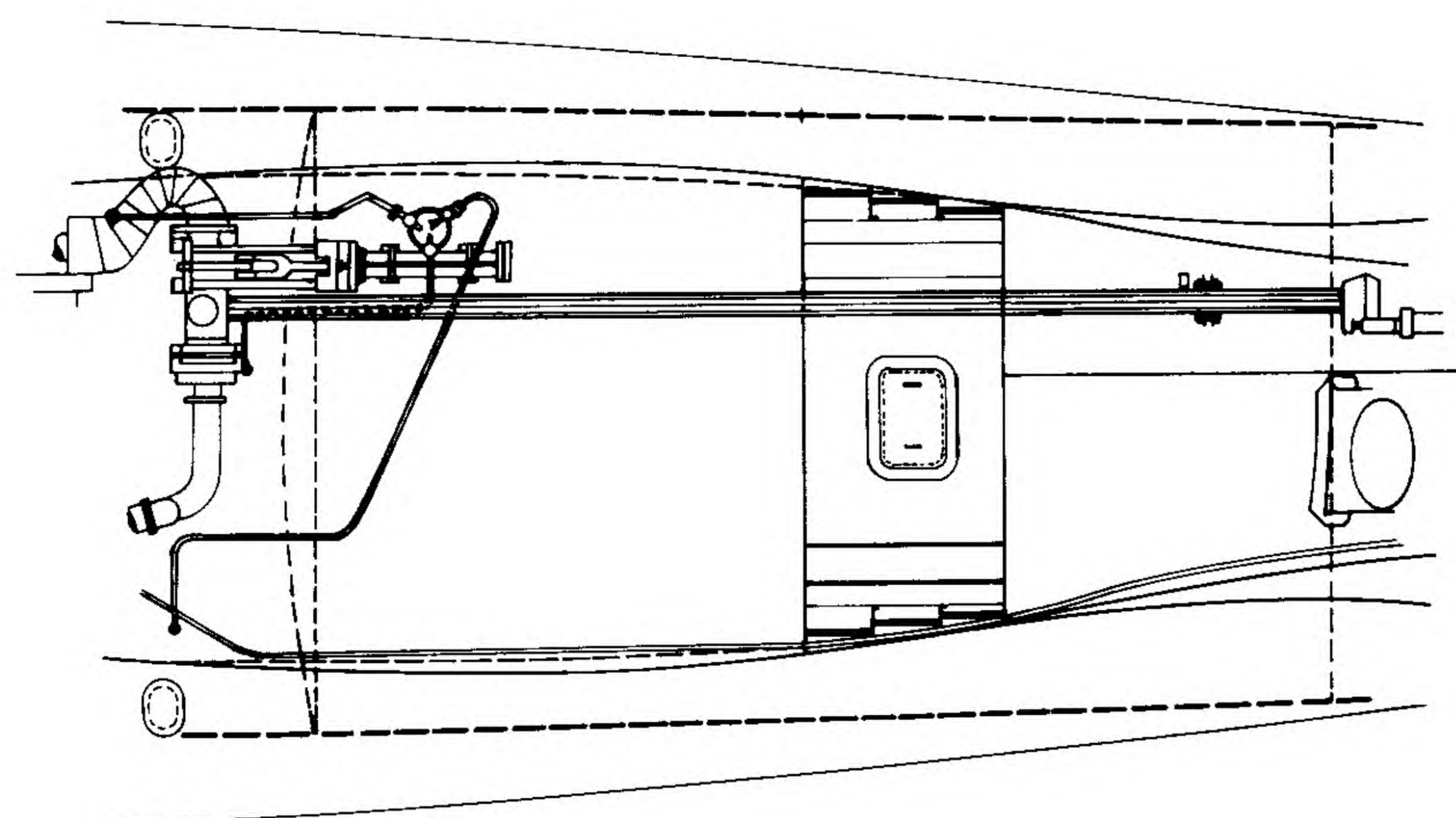
D6/1 OFFICERS' AND SENIOR RATES' QUARTERS, INTERNAL PROFILE

- 1 Access hatch through forward main bulkhead
- 2 Forward main bulkhead
- 3 Air pipe
- 4 Battery self-regulating room access door
- 5 Bunks
- 6 Lockers and shelves
- 7 Schnorchel mast (stowed)
- 8 Outer casing deck
- 9 Locker
- 10 Battery loading hatch
- 11 Wardrobe
- 12 Senior ratings' bunks
- 13 Access door to forward heads
- 14 Schnorchel head
- 15 Battery ventilation pipe
- 16 Main fuel tank Ili
- 17 Magazine pallet
- 18 Ammunition boxes
- 19 Washing water tank
- 20 Forward battery room
- 21 Individual battery cells
- 22 Battery room cushioned flooring
- 23 Keel
- 24 Forward torpedo room
- 25 Hold of forward torpedo room



D6/1

D6/2 OFFICERS' AND SENIOR RATES' QUARTERS, PLAN OF PRESSURE HULL ABOVE
(showing the general arrangement of the Schnorchel piping and the battery loading hatch; this was sealed. The high pressure air hoses are also to be seen)



D6/2

D Compartments

D6/3 OFFICERS' AND SENIOR RATES' QUARTERS, PLAN AT DECK LEVEL

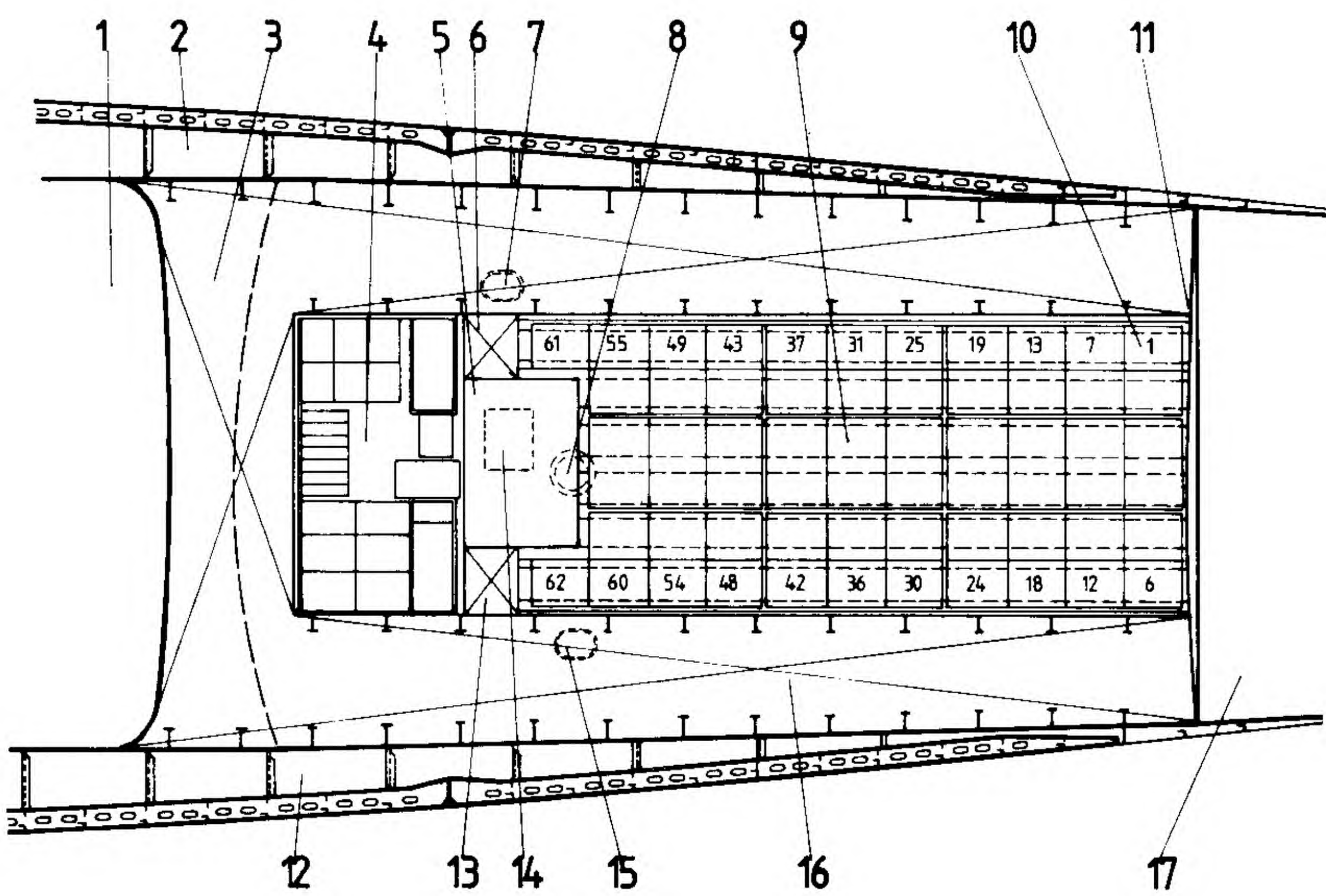
- 1 Pressure-tight bulkhead door to control room
- 2 Saddle-tank, diving tank 4
- 3 Saddle-tank stringer
- 4 Battery self-regulating room 2
- 5 Access hatch to battery space (below)
- 6 Captain's bunk
- 7 Locker ('L' being common)
- 8 Air-tight locker for confidential books
- 9 Access hatch to magazine
- 10 Mess table
- 11 Bunks (2)
- 12 Heads
- 13 Forward torpedo room
- 14 Bulkhead
- 15 Radio room
- 16 Sound location room
- 17 Ballast tank 4
- 18 Fresh water tank 2
- 19 Chief rates' mess
- 20 Mess table (folding)
- 21 Food store
- 22 Bulkhead
- 23 Access hatch to forward torpedo room



D6/3

D6/4 OFFICERS' AND CHIEF RATES' QUARTERS, PLAN BELOW DECK LEVEL (battery room II)

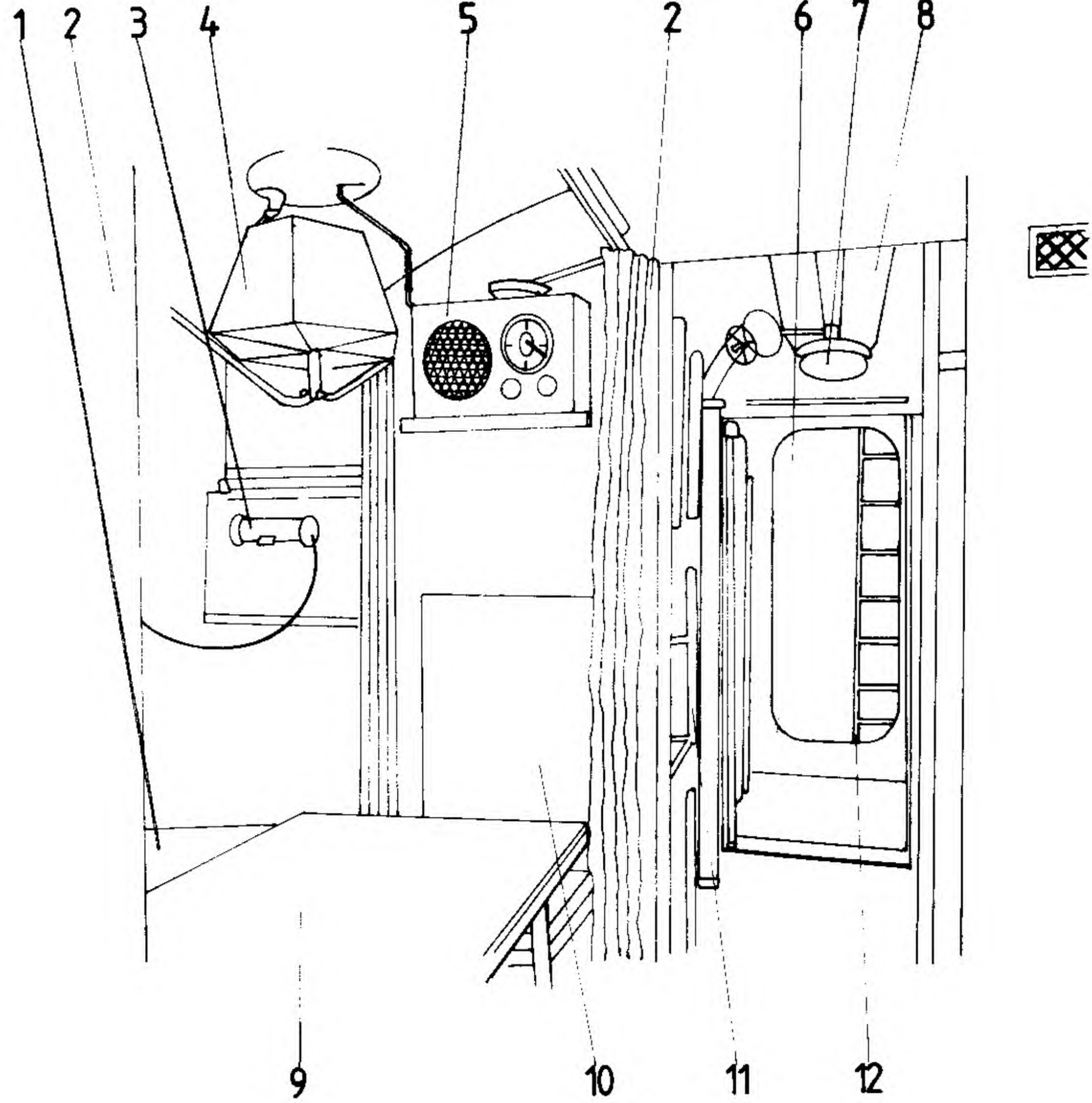
- 1 Main diving tank
- 2 Ballast tank 4
- 3 Main fuel tank Ili
- 4 Magazine
- 5 S-Gerät room
- 6 Dirty water tank 2
- 7 Water inlet valve
- 8 Bilge access
- 9 Battery cells of forward battery room
- 10 Cell number 1-cells were numbered port to starboard, from forward aft
- 11 Forward bulkhead
- 12 Diving tank 4
- 13 Washing water tank
- 14 Access to bilge
- 15 Water inlet valve
- 16 Starboard section of main fuel tank Ili
- 17 Hold of forward torpedo room



D6/4

D6/5 **GENERAL VIEW OF CAPTAIN'S QUARTERS (looking forward; no scale)**

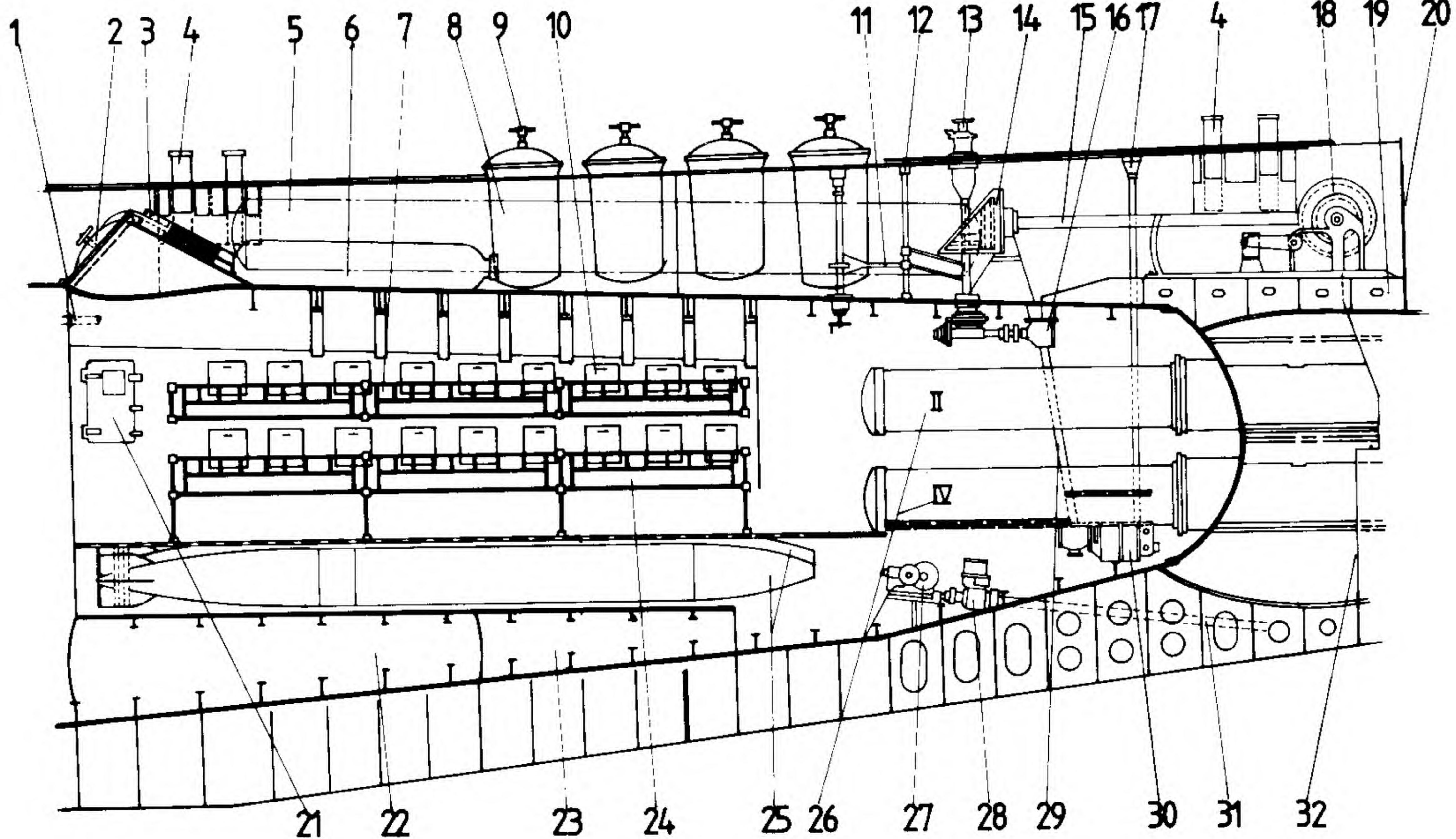
- 1 Captain's bunk/seat
- 2 Curtain
- 3 Reading light
- 4 Main light
- 5 Radio/intercom and course repeater
- 6 Hatch to forward torpedo room
- 7 Light
- 8 Air trunking
- 9 Captain's table
- 10 Chair
- 11 Wardroom bunks
- 12 Forward torpedo tube loading hatch ladder



D6/5

D7/1 **BOW TORPEDO ROOM AND CREW'S QUARTERS, INTERNAL PROFILE**

- 1 Air supply piping
- 2 Forward torpedo loading hatch cover
- 3 Easing spring for torpedo loading hatch cover
- 4 Forward bollards (removable at sea)
- 5 Forward reserve torpedo watertight container (1 torpedo)
- 6 High pressure air group 6
- 7 Crew's bunks
- 8 Watertight container for 5 man inflatable life raft (four such)
- 9 Release handle for lid
- 10 Personal locker
- 11 Control linkage for windlass/capstan
- 12 Deck control point for windlass/capstan
- 13 Capstan head
- 14 Gear mounting for windlass/capstan
- 15 Transmission arm to windlass
- 16 Universal joint on power transmission
- 17 Motor control
- 18 Anchor windlass
- 19 Reinforced support plating for windlass
- 20 Forward collision bulkhead
- 21 Watertight locker
- 22 Torpedo compensating tank 2
- 23 Forward trim tank
- 24 Bunk mattress
- 25 Reserve torpedoes
- 26 Torpedo tubes (II and IV, as marked)
- 27 Hydraulic controls for hydroplane arm drive motor
- 28 Hydroplane drive motor
- 29 Transmission shaft for windlass/capstan motor
- 30 Windlass/capstan motor
- 31 Attitude control arm for forward hydroplanes
- 32 Anchor chain locker (free-flooding)

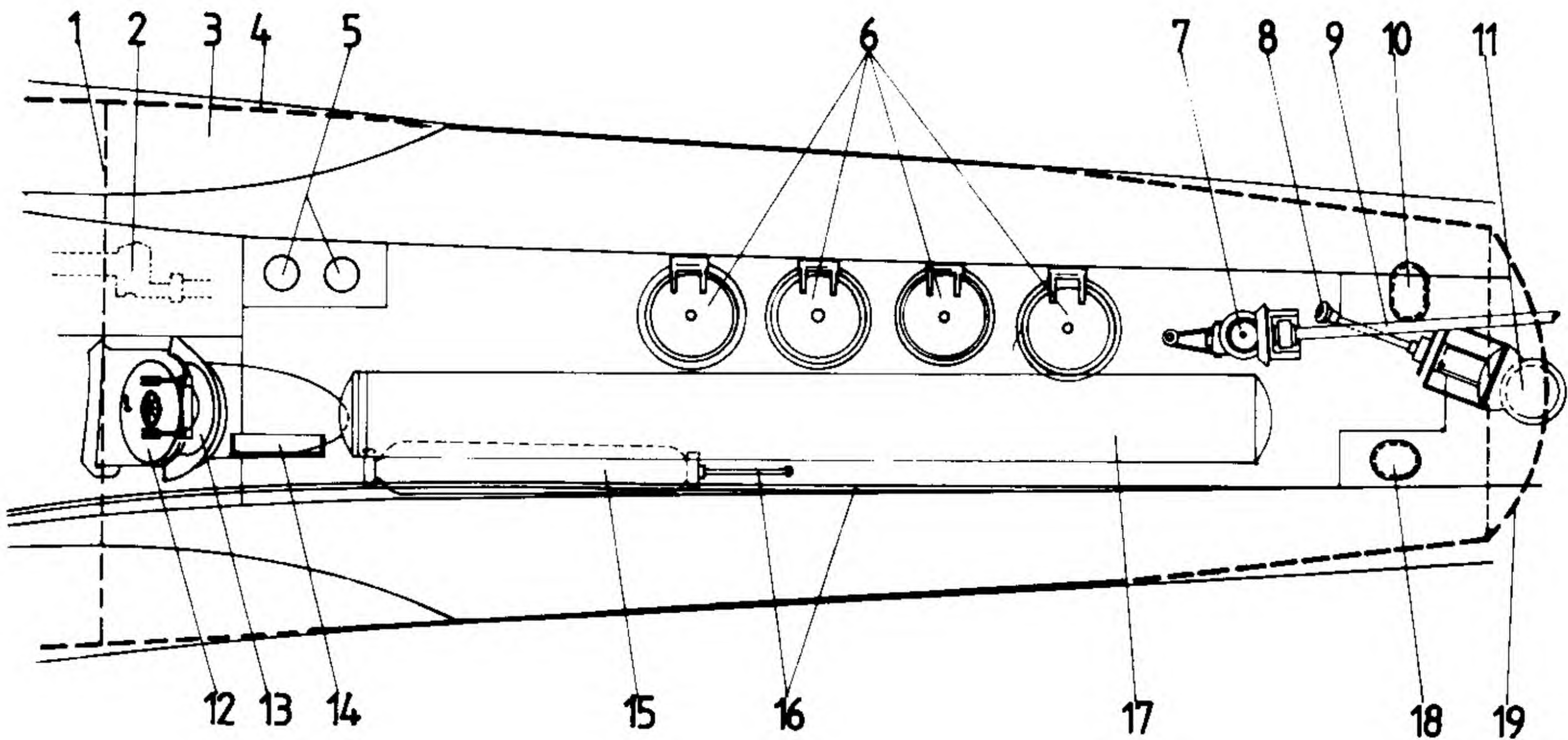


D7/1

D Compartments

D7/2 BOW TORPEDO ROOM AND CREW'S QUARTERS, PLAN OF DECK BELOW CASING ABOVE COMPARTMENT

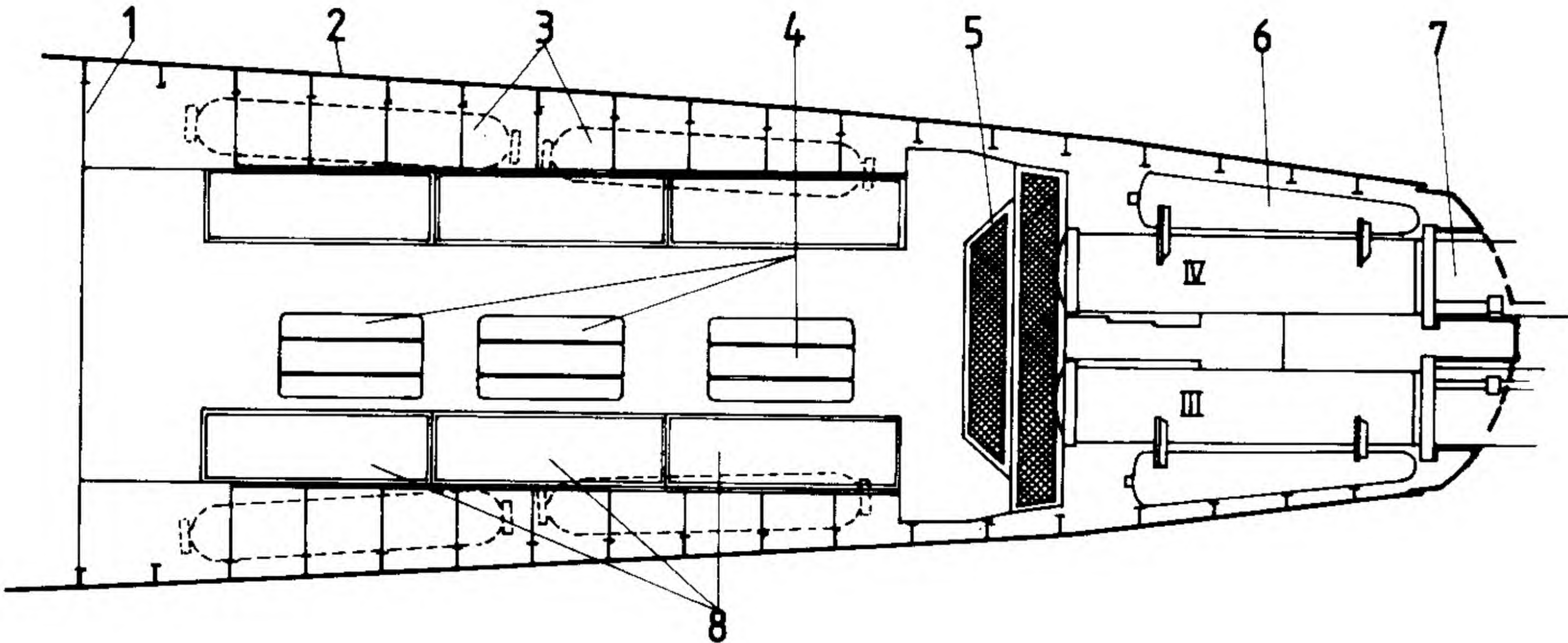
- 1 Rear bulkhead of compartment (within pressure hull)
- 2 Head of Schnorchel (when fitted)
- 3 Port saddle-tank
- 4 Line of pressure hull
- 5 Removable bollards
- 6 Four 5 man inflatable life raft containers (watertight)
- 7 Gears for windlass/capstan
- 8 Control arm for forward diving tank vent
- 9 Drive shaft for anchor windlass
- 10 Access and charging plate for high pressure air bottles of group 6
- 11 Vent for forward diving tank
- 12 Forward torpedo loading hatch
- 13 Collision cowling for loading hatch
- 14 Easing spring for loading hatch
- 15 High pressure air bottle (part of group 6)
- 16 Air hoses to forward diving tank and (aft) forward trim tank
- 17 Reserve torpedo container (watertight)
- 18 Access plate to air connections to forward diving tank
- 19 Line of pressure casing bow cap



D7/2

D7/3 BOW TORPEDO ROOM AND CREW'S QUARTERS, PLAN AT DECK LEVEL

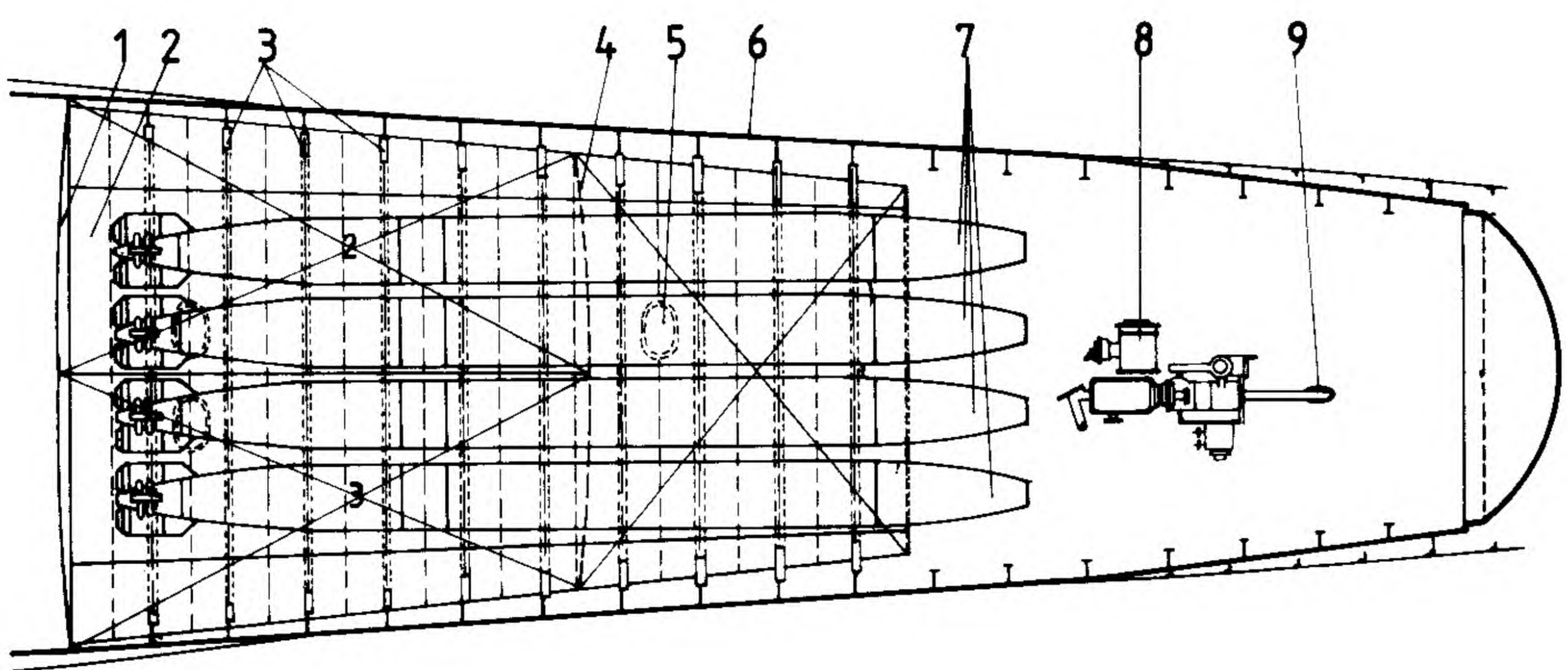
- 1 Bulkhead
- 2 Pressure hull
- 3 High pressure air bottles of group 4
- 4 Folding mess table
- 5 Grating
- 6 High pressure air bottle for port torpedo tube IV
- 7 Torpedo tube IV
- 8 Bunks



D7/3

D7/4 BOW TORPEDO ROOM AND CREW'S QUARTERS, PLAN AT LEVEL OF THE HOLD

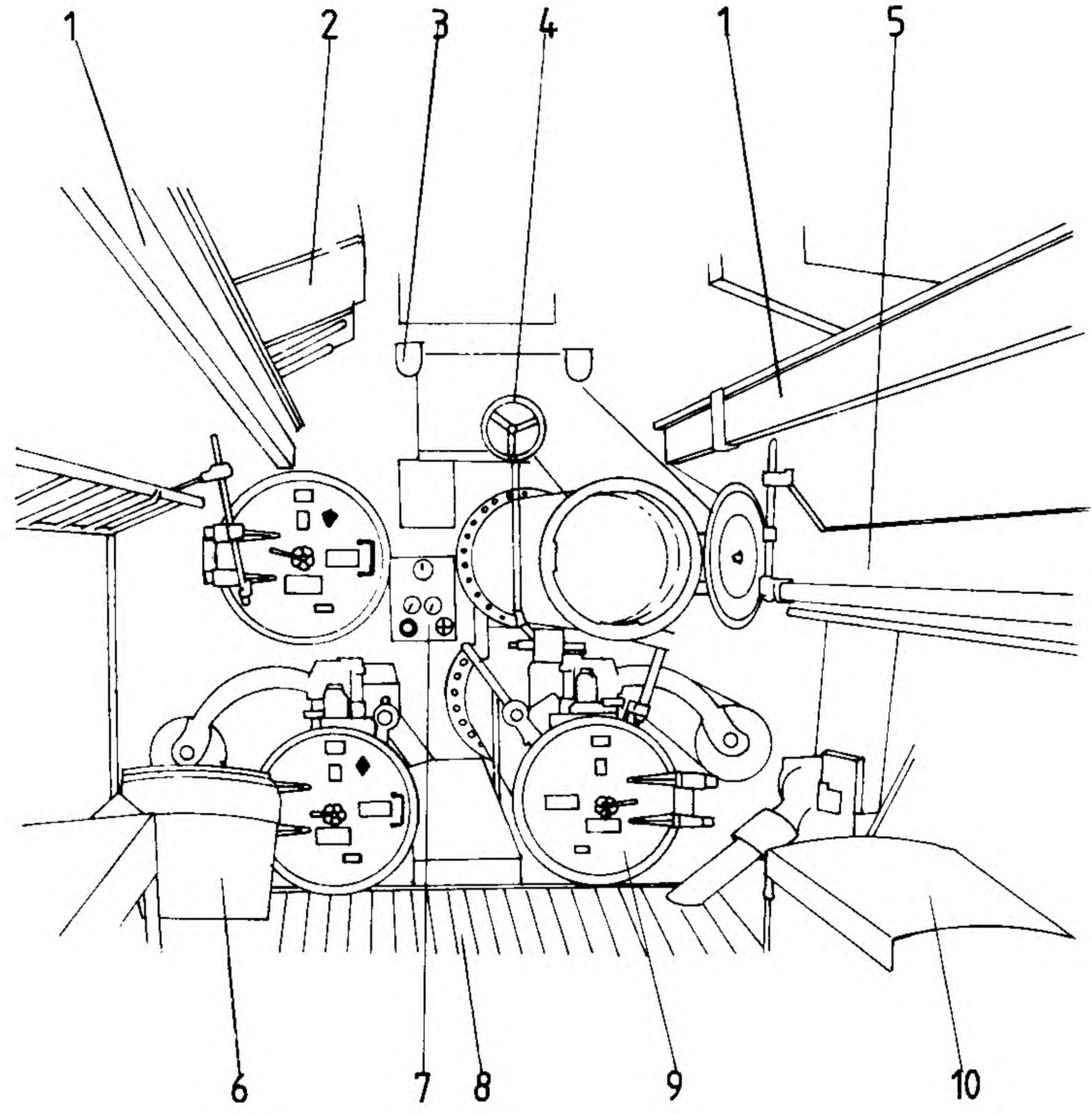
- 1 Lower bulkhead
- 2 Hold
- 3 Frames
- 4 Bulkhead of torpedo compensating tanks 2 and 3
- 5 Main water inlet
- 6 Pressure hull
- 7 Reserve torpedoes
- 8 Forward hydroplane motor hydraulic reservoir
- 9 Forward hydroplane control arm gland



D7/4

D7/5 FORWARD TORPEDO ROOM (general view; no scale)

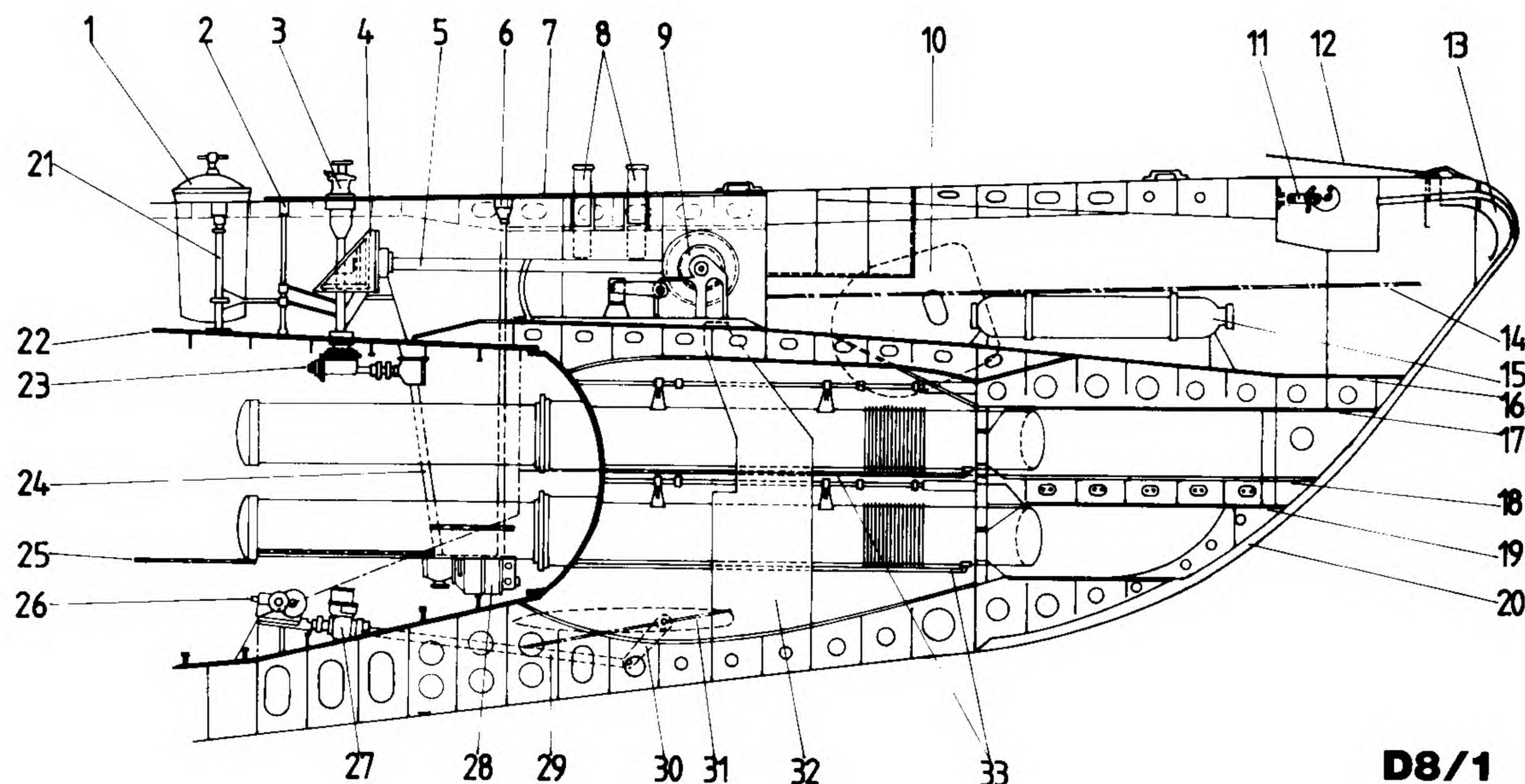
- 1 Support beam for torpedo stowage and loading
- 2 Air blower
- 3 Light
- 4 Control wheel for capstan/windlass control
- 5 Storage space
- 6 Spares container
- 7 Torpedo setting dials (repeated from bridge computer)
- 8 Deck
- 9 Torpedo tube III
- 10 Bunk/seat



D7/5

D Compartments

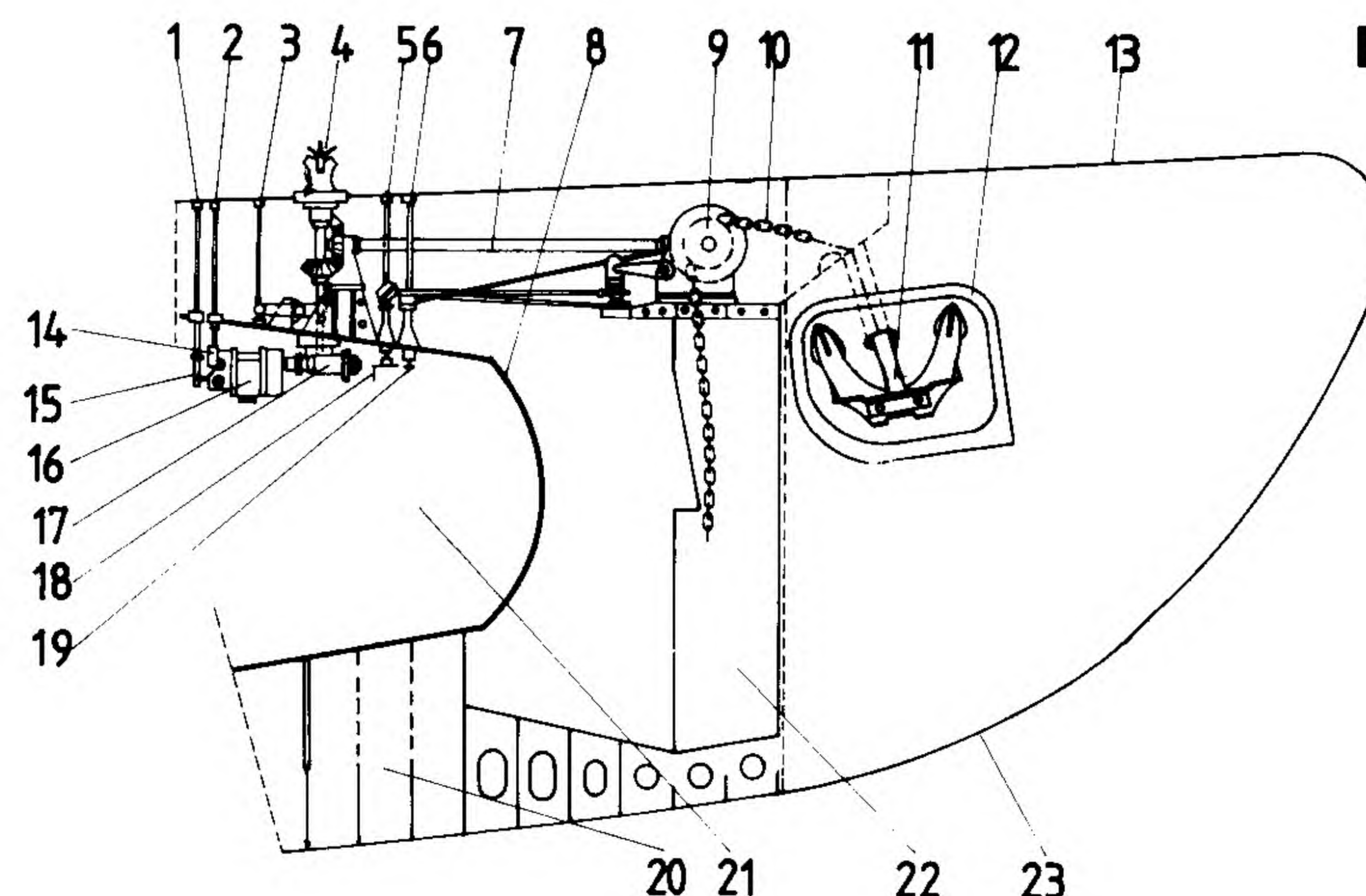
- D8/1 BOW SECTION, INTERNAL PROFILE**
- 1 Watertight 5 man inflatable life raft container
 - 2 Deck control point for capstan/windlass
 - 3 Capstan head (removable at sea)
 - 4 Mounting for anchor windlass drive shaft
 - 5 Anchor windlass drive shaft
 - 6 Speed/direction control for capstan/windlass motor
 - 7 Outer casing deck
 - 8 Bollards (removable at sea)
 - 9 Anchor windlass
 - 10 Anchor housing (starboard only), with hawse hole shown in solid line
 - 11 Forward towing hook
 - 12 Jumping wire, supporting forward aerial
 - 13 Bow casing reinforcement
 - 14 Stringer II
 - 15 High pressure air bottle
 - 16 'E' Deck
 - 17 'D' Deck
 - 18 'C' Deck (below is stringer III)
 - 19 'B' Deck
 - 20 Bow casing (bow shown here is the modified Atlantic bow)
 - 21 Selector lever for capstan/windlass control
 - 22 Pressure hull
 - 23 Gear box
 - 24 Motor drive shaft
 - 25 Working deck
 - 26 Hydroplane attitude control motor (hydraulic)
 - 27 Rear housing for hydroplane control arm
 - 28 Capstan/windlass motor (electric)
 - 29 Outline of starboard hydroplane
 - 30 Hydroplane control link arm
 - 31 Stringer I
 - 32 Chain locker
 - 33 Torpedo tube drainage pipes (Stringer III runs alongside the pipe to tube I)



D8/1

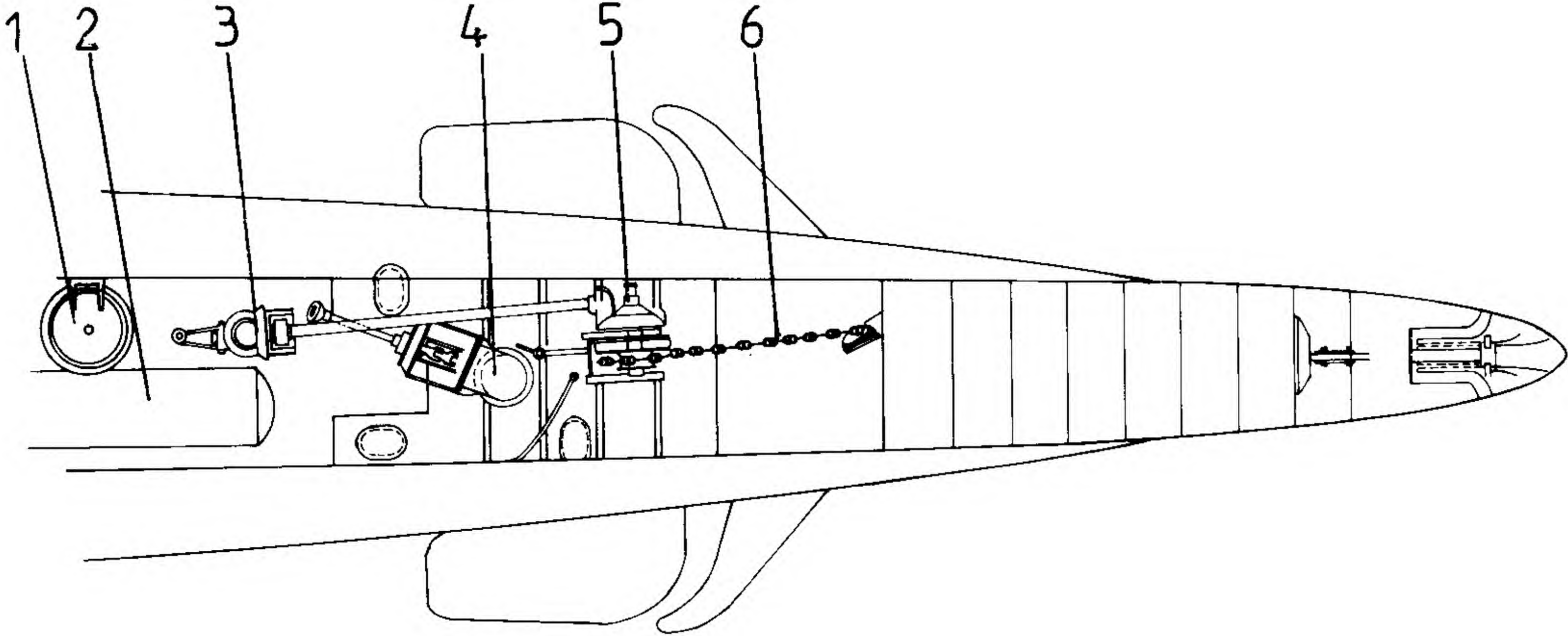
- D8/2 BOW SECTION, ANCHOR, CAPSTAN AND WINDLASS CONTROLS (no scale)**
- 1 Deck gear control for capstan
 - 2 Deck brake for capstan
 - 3 Selector arm for capstan/windlass drive
 - 4 Capstan (removable at sea)
 - 5 Deck gear control for windlass drive
 - 6 Deck brake for windlass drive
 - 7 Drive shaft for windlass drum
 - 8 Pressure hull fore end
 - 9 Windlass drum
 - 10 Anchor chain

- 11 Anchor (standard U-boat pattern)
- 12 Anchor housing (outer casing)
- 13 Outer casing deck
- 14 Internal brake for capstan
- 15 Internal gear control for capstan
- 16 Drive motor for capstan/windlass
- 17 Reduction gear box
- 18 Internal gear control for capstan/windlass drive
- 19 Internal brake for capstan/windlass drive
- 20 Diving tank 5
- 21 Torpedo/crew compartment
- 22 Chain locker (free-flooding)
- 23 Line of outer casing below bow



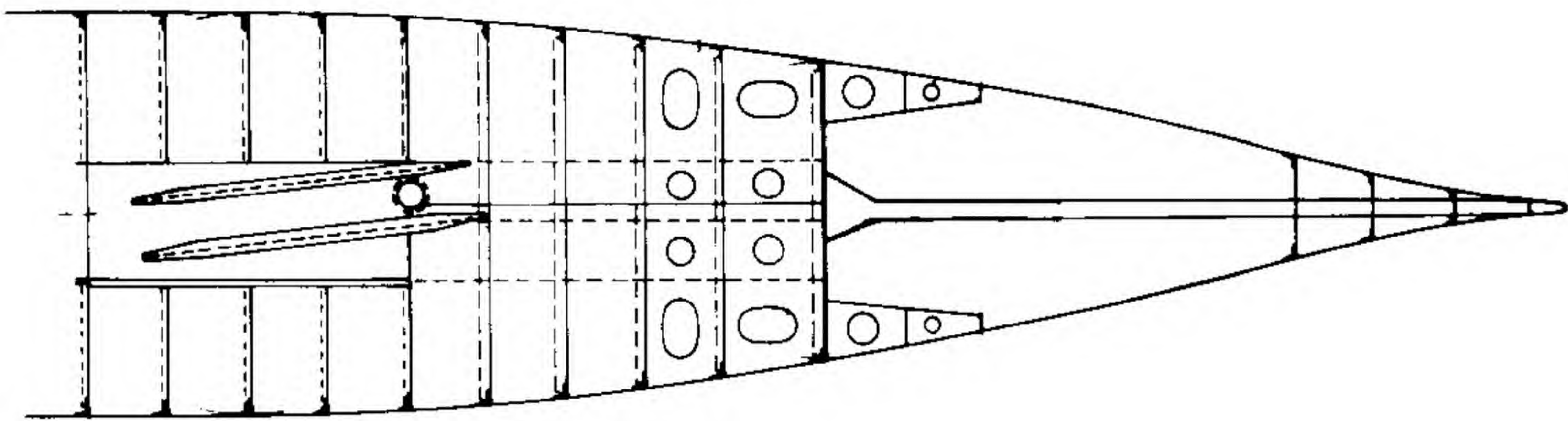
D8/2

- D8/3 BOW SECTION, PLAN BENEATH CASING LEVEL**
- 1** Watertight 5 man inflatable life raft container lid
 - 2** Reserve torpedo stowage container (watertight)
 - 3** Gearing for drive to capstan/windlass
 - 4** Blowing vent, forward diving tank
 - 5** Anchor windlass
 - 6** Anchor chain



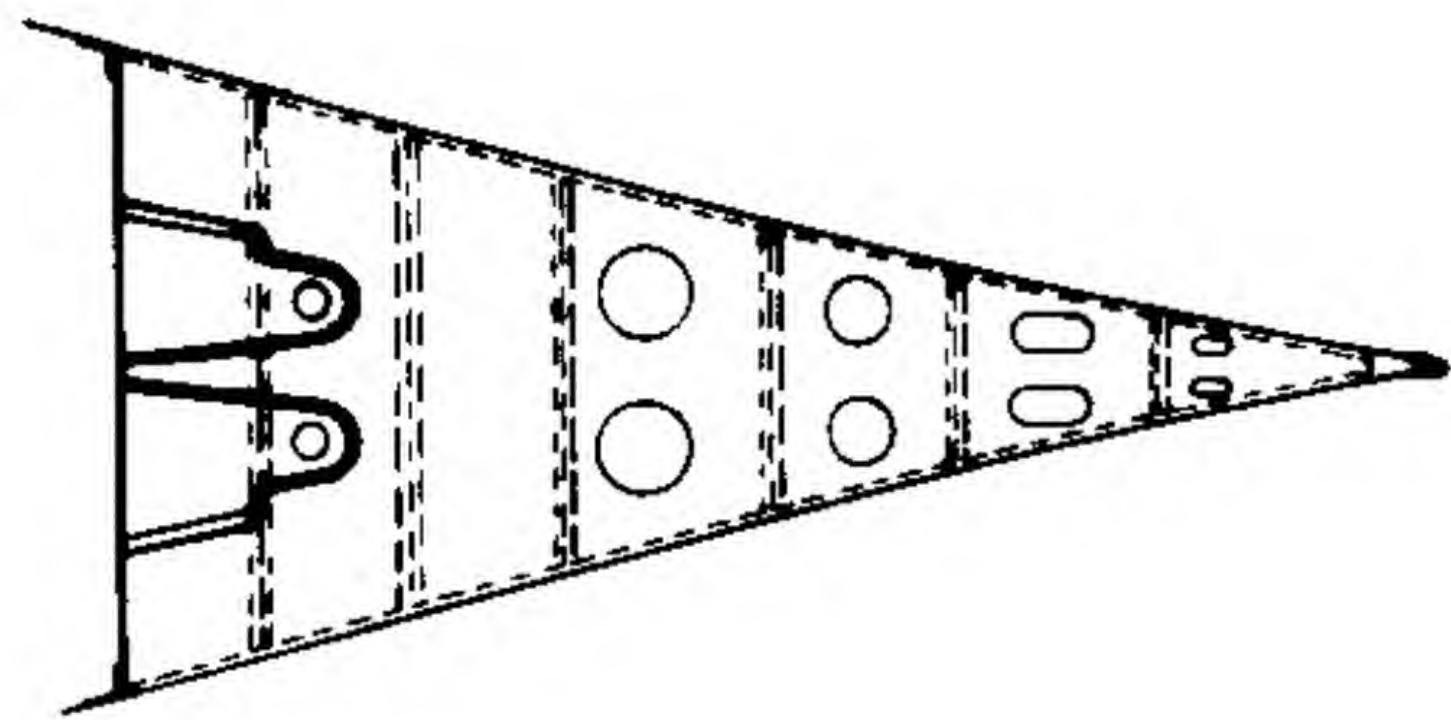
D8/3

- D8/4 BOW SECTION PLAN AT 'E' DECK (the drawing shows the anchor windlass mountings, anchor hawse hole and the lower central bow support beam)**



D8/4

- D8/5 BOW SECTION, PLAN AT 'D' DECK (the drawing shows the upper positions of the torpedo tube door mounting pins as well as the decking at the same level)**



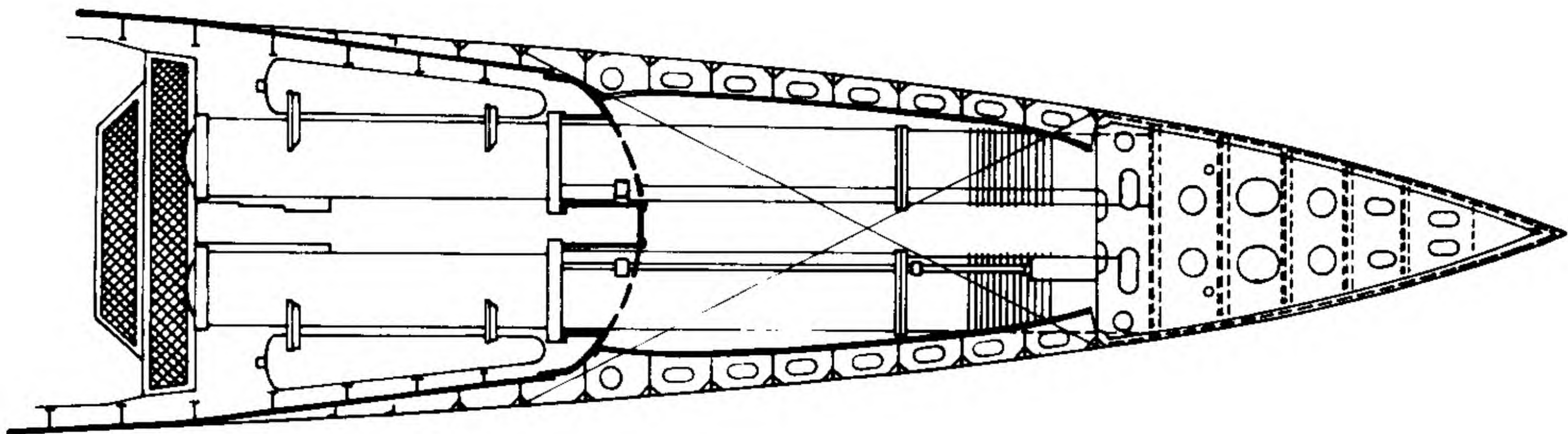
D8/5

D Compartments

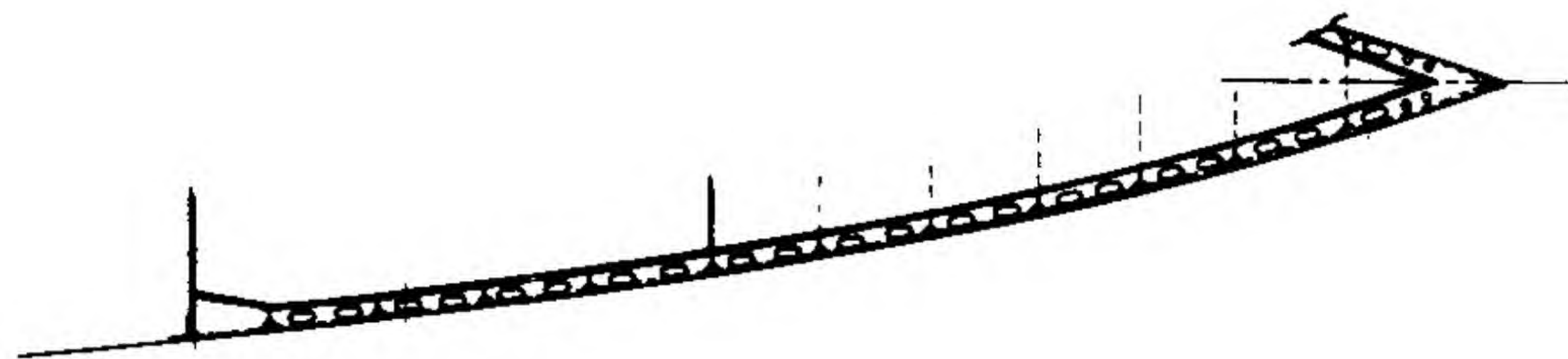
- D8/6

BOW SECTION, PLAN AT 'C' DECK (the plan shows torpedo tubes III and IV, diving tank 5 and the perforated deck plating which was used throughout to combine required strength with a degree of lightness)
- D8/7

BOW SECTION, STRINGER III (this stringer was one of the main longitudinal bow supports, and was fitted immediately below 'C' Deck)



D8/6



D8/7

- D8/8

BOW SECTION, PLAN AT 'B' DECK

1

Torpedo tube I

2

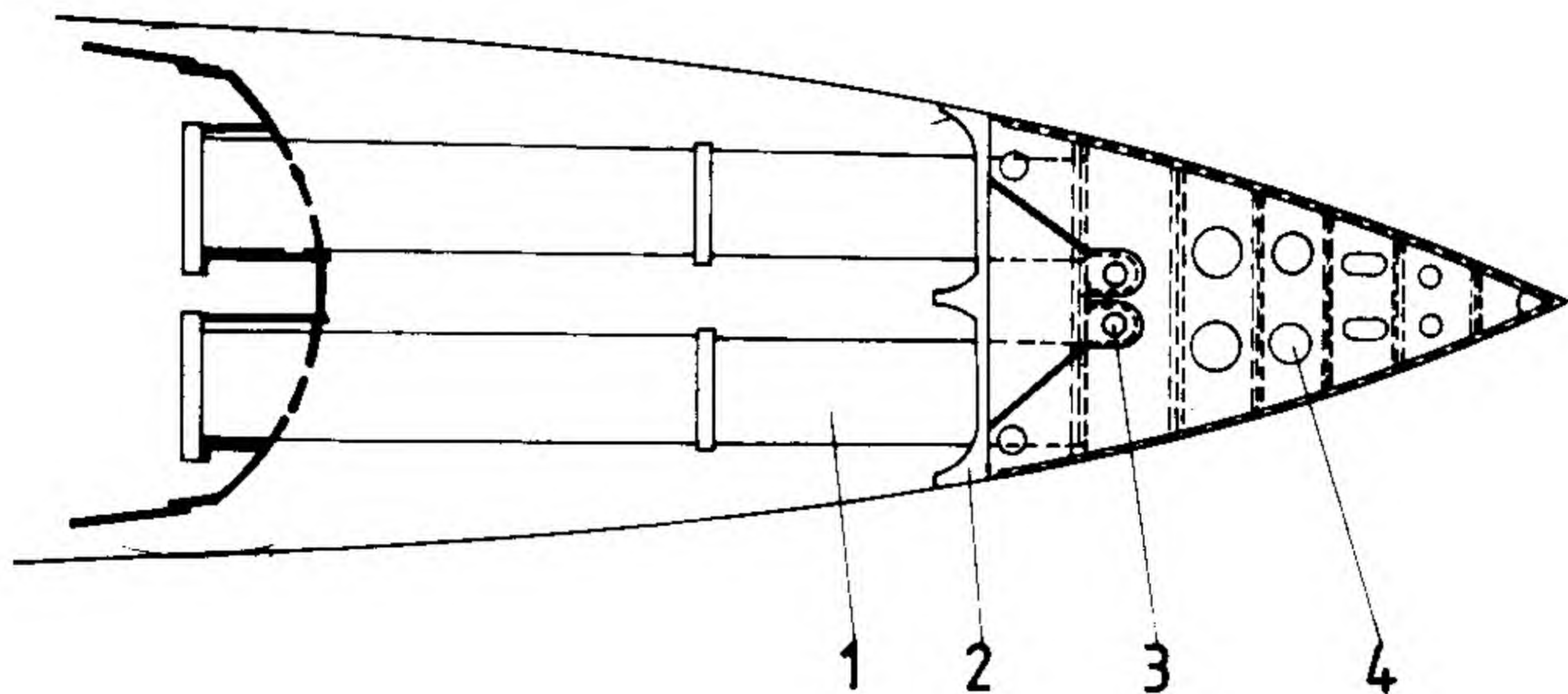
Torpedo tube mounting plate and collision bulkhead

3

Torpedo tube door mounting pin for tube I

4

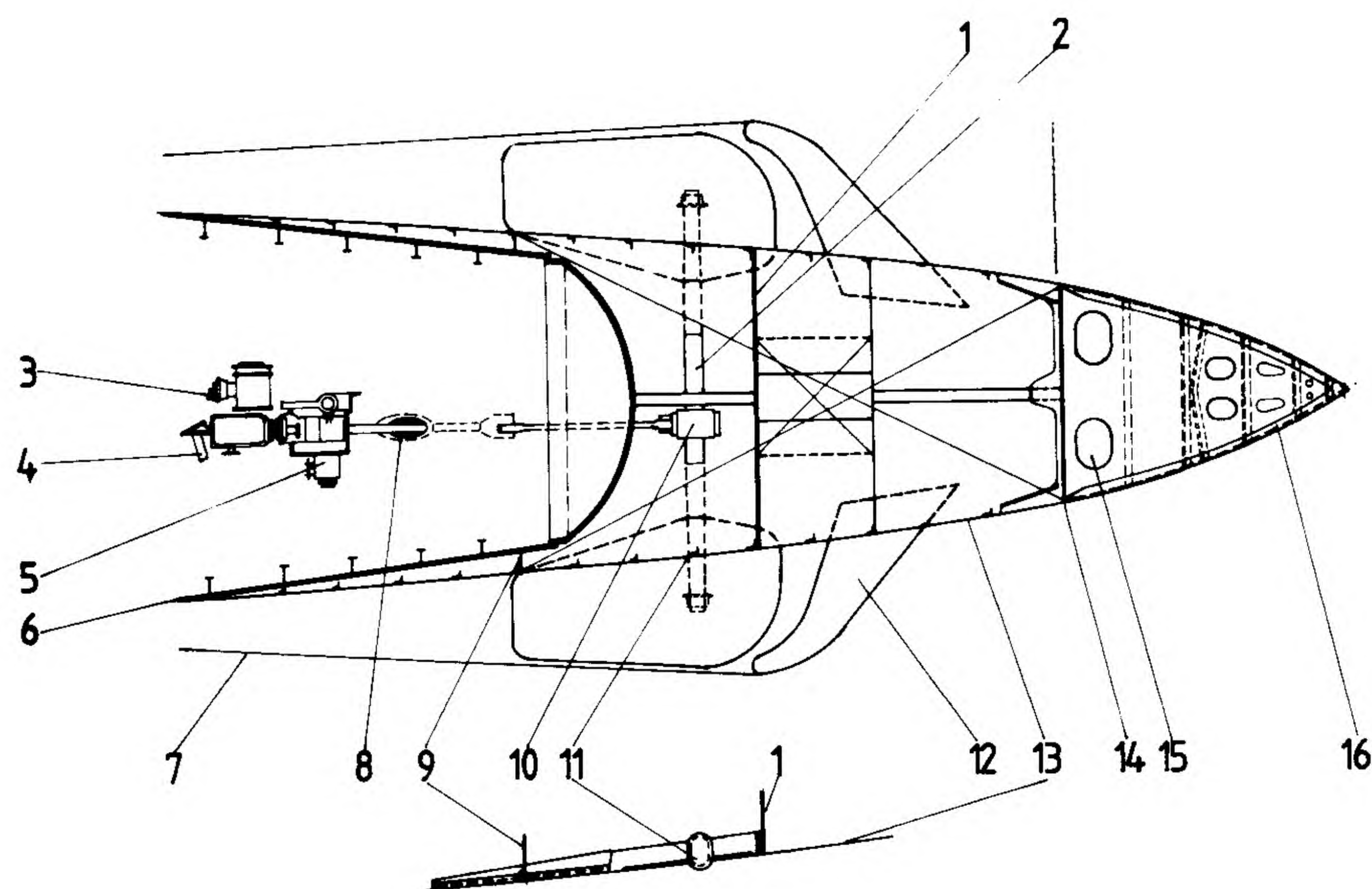
Lightening holes in 'B' deck plating



D8/8

**D8/9 BOW SECTION, PLAN AT 'A'
DECK AND STRINGER I**

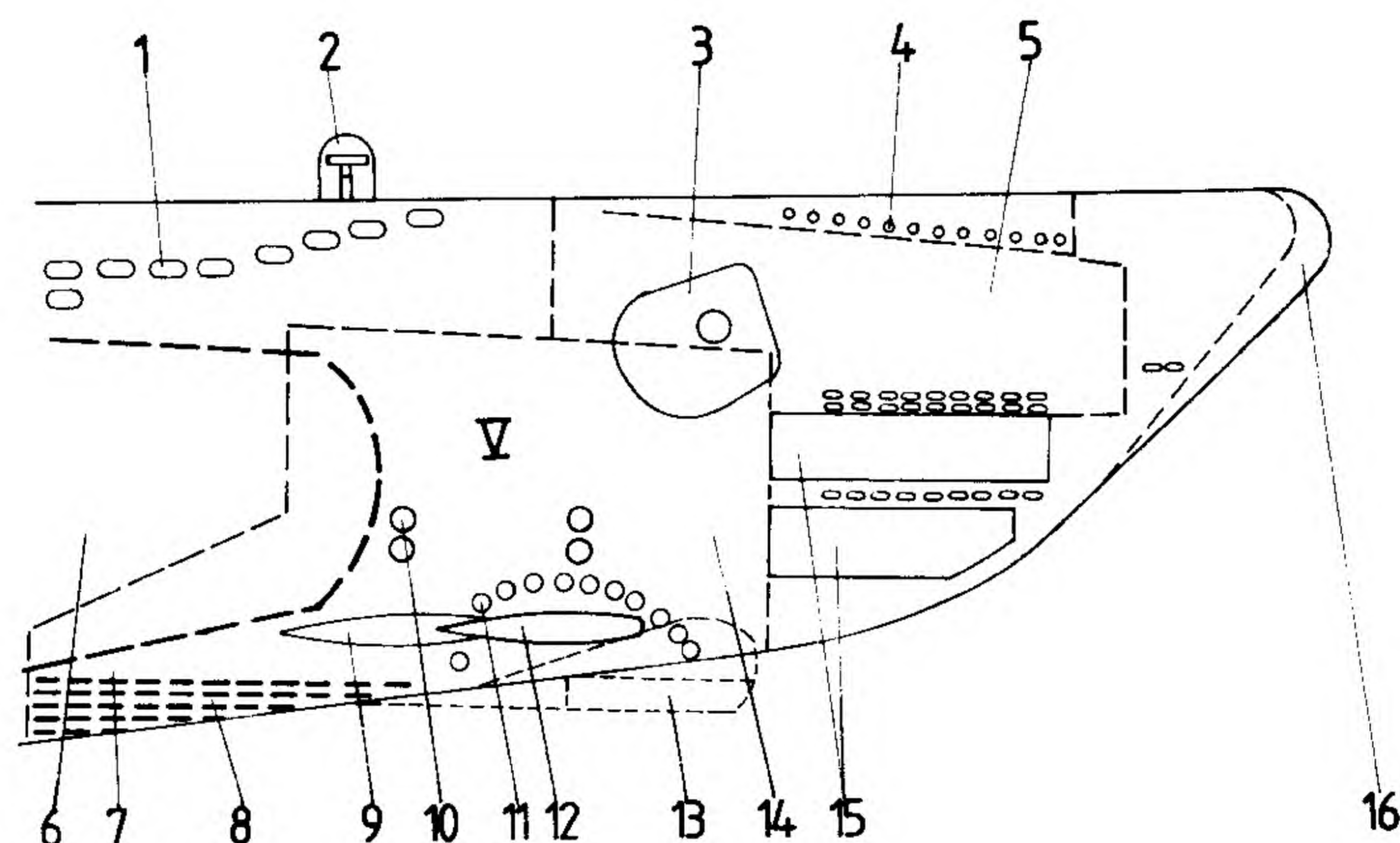
- 1 External collision bulkhead
- 2 Hydroplane mounting arm
- 3 Hydroplane motor hydraulic reservoir
- 4 Hydroplane motor control linkage from control room (hydraulic)
- 5 Hydroplane attitude control motor
- 6 Pressure hull
- 7 Hydroplane fairing support wire
- 8 Hydroplane control arm gland in pressure hull
- 9 Frame 97
- 10 Hydroplane mounting arm housing
- 11 Casing gland for hydroplane mounting arm
- 12 Hydroplane fairing
- 13 Outer casing
- 14 Bow collision bulkhead
- 15 Lightening holes in deck plating
- 16 Bow reinforcement



D8/9

D8/10 UNDERWATER SENSORS (this drawing is a composite, showing the various types of listening equipment available to the Type VII U-boats - most were fitted with one or more of the devices drawn, but none had all of the sets shown)

- 1 Upper casing drainage slots
- 2 KDB (*Kristalldrehbasisgerät*) rotating hydrophone (could give bearings to an accuracy of plus or minus 1°, but range was far less than GHG below)
- 3 Anchor housing
- 4 Forward casing drainage holes
- 5 Forward watertight casing (outlined)
- 6 Forward torpedo room and crew's quarters
- 7 Outline of pressure hull
- 8 Drainage slots for lower forward casing
- 9 Forward hydroplane
- 10 UT (underwater listening equipment)
- 11 GHG (*Gruppenhorchgerät* or group listening device) could detect single ships at up to 20km and convoys at nearly 100km. There were originally 11 and then 24 receivers per side
- 12 Fairing for forward hydroplane
- 13 Another UT
- 14 Diving tank 5
- 15 Bow doors for torpedo tubes numbers I and III
- 16 Atlantic bow—the original Type VII form is shown as hatched lines



D8/10

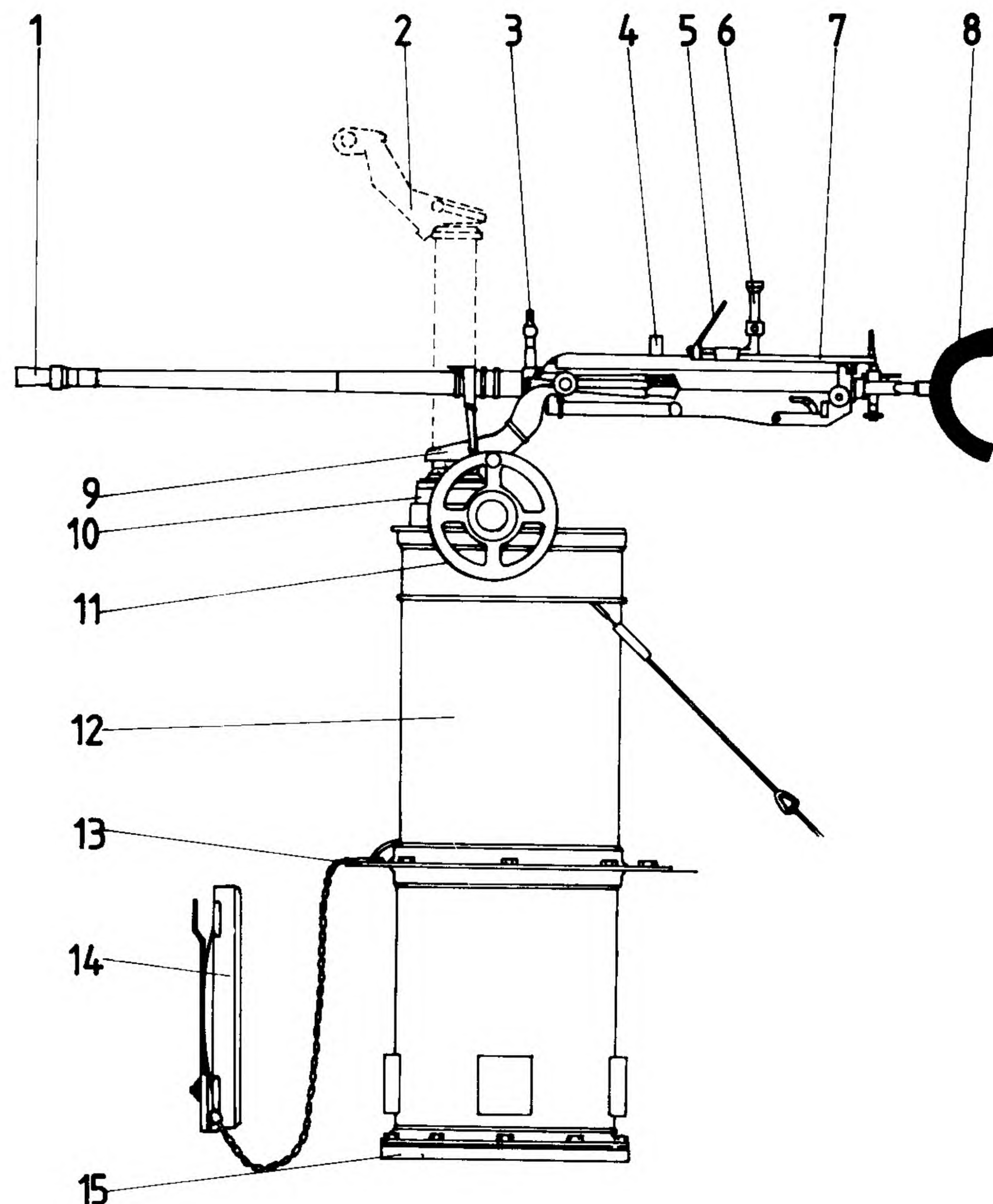
E Armament and fittings

**E1 2cm MG C30 ON WATERTIGHT
CANISTER MOUNTING (1/25
scale)**

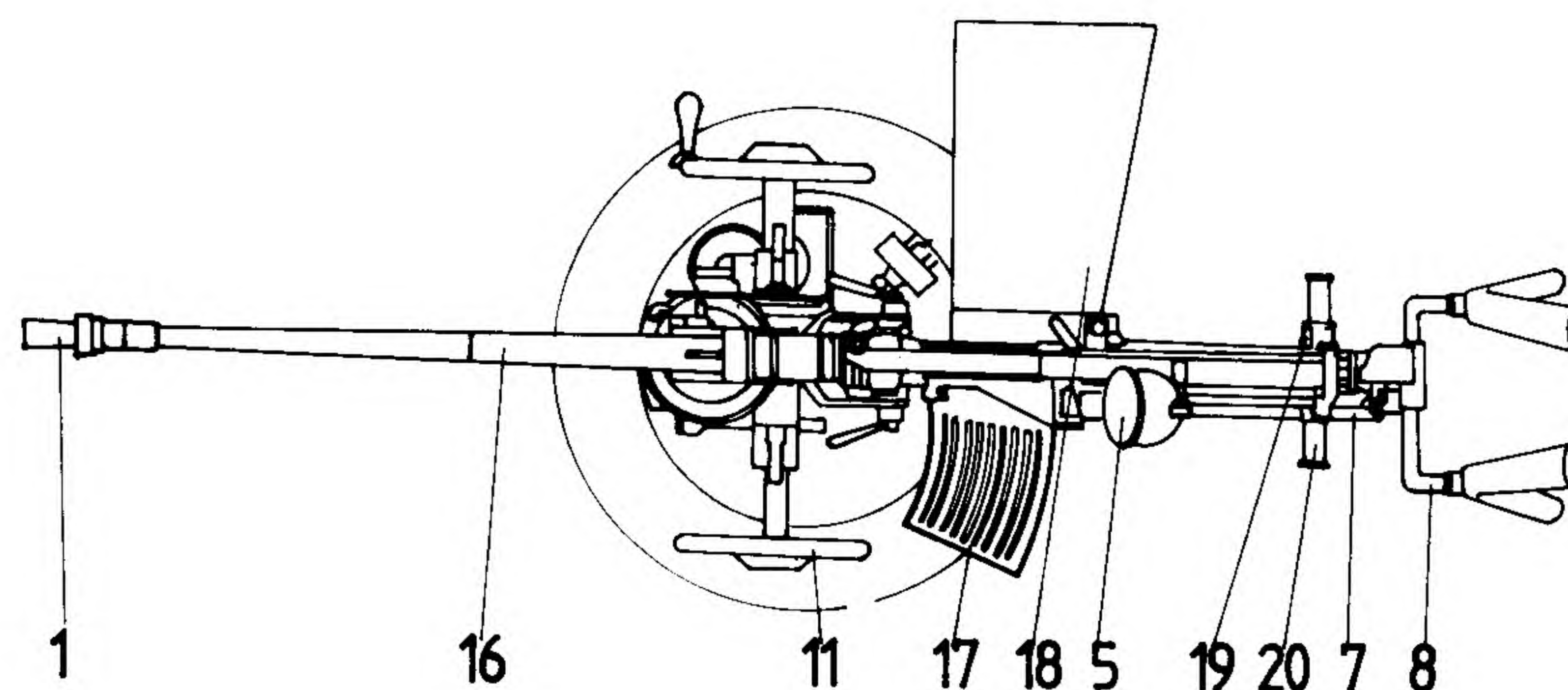
E1/1 Elevation

E1/2 Plan

- 1 Flash guard
- 2 Mount position when raised for
anit-aircraft work
- 3 Surface action fore sight
- 4 Cocking handle
- 5 Ring sight, anti-aircraft targets
- 6 Rear sight post for surface work
- 7 Breech cover
- 8 Gunner's shoulder pads
- 9 Rotating arm (free-swinging)
- 10 Fixed sleeve for rotating arm
- 11 Elevating wheel for mounting (to
raise or lower gun)
- 12 Watertight canister for equipment
- 13 Safety chain for canister lid
- 14 Canister lid
- 15 Deck mounting
- 16 Barrel
- 17 20-round magazine
- 18 Empty case receiver
- 19 Firing trigger
- 20 Gunner's hand grip



E1/1



E1/2

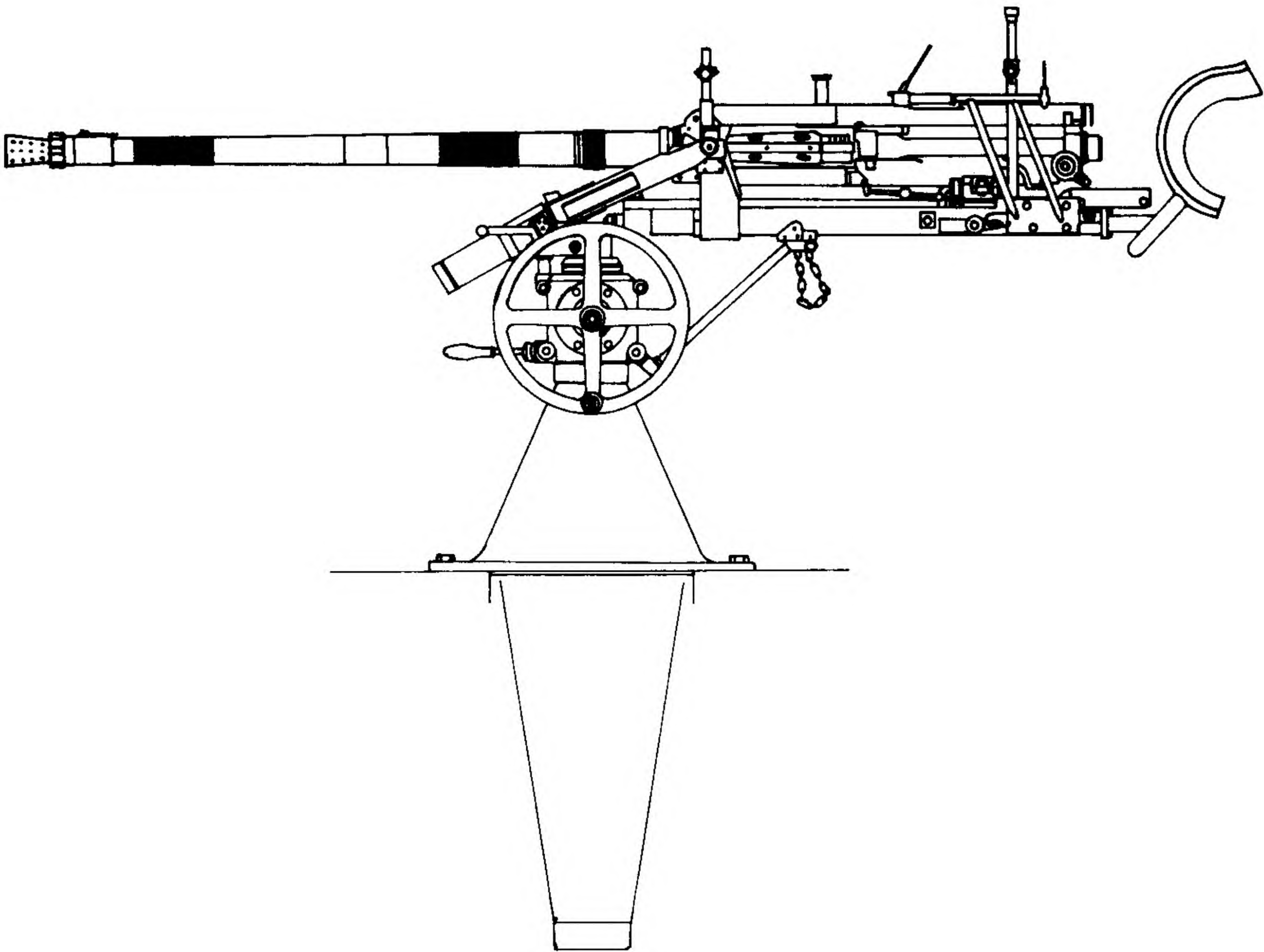
E2 2cm MG C30 ON LC 30/37
MOUNTING

E2/1 Elevation

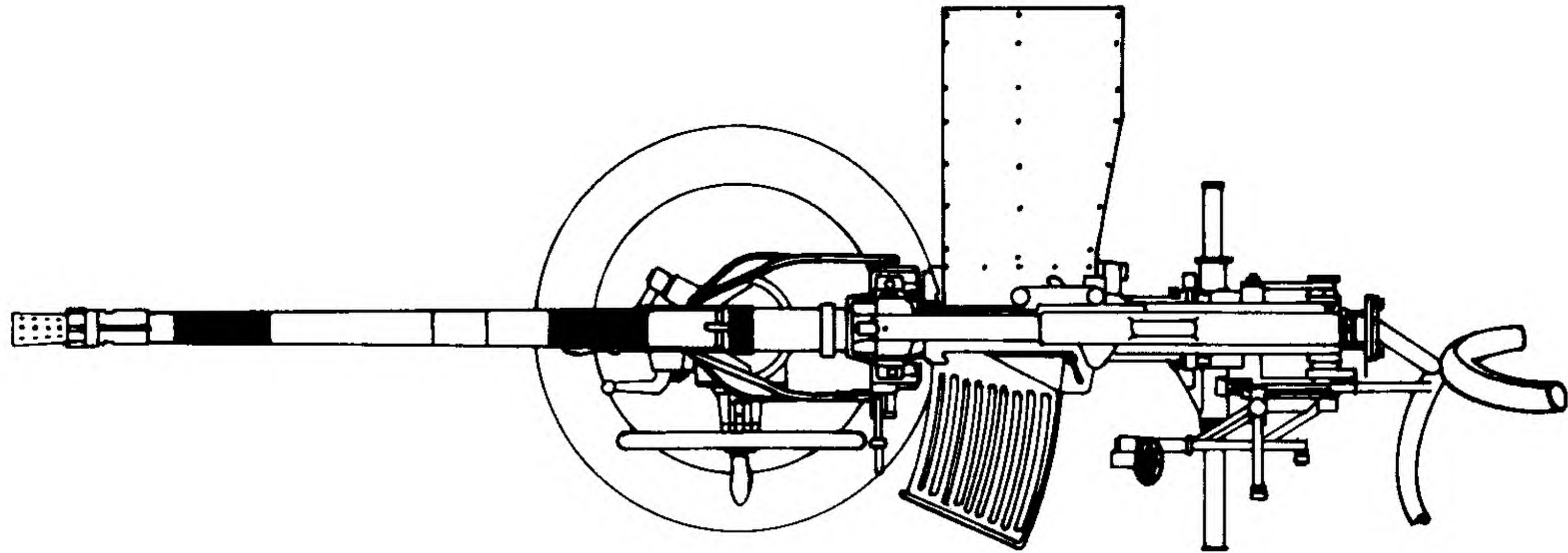
E2/2 Plan

E2/3 General view (no scale)

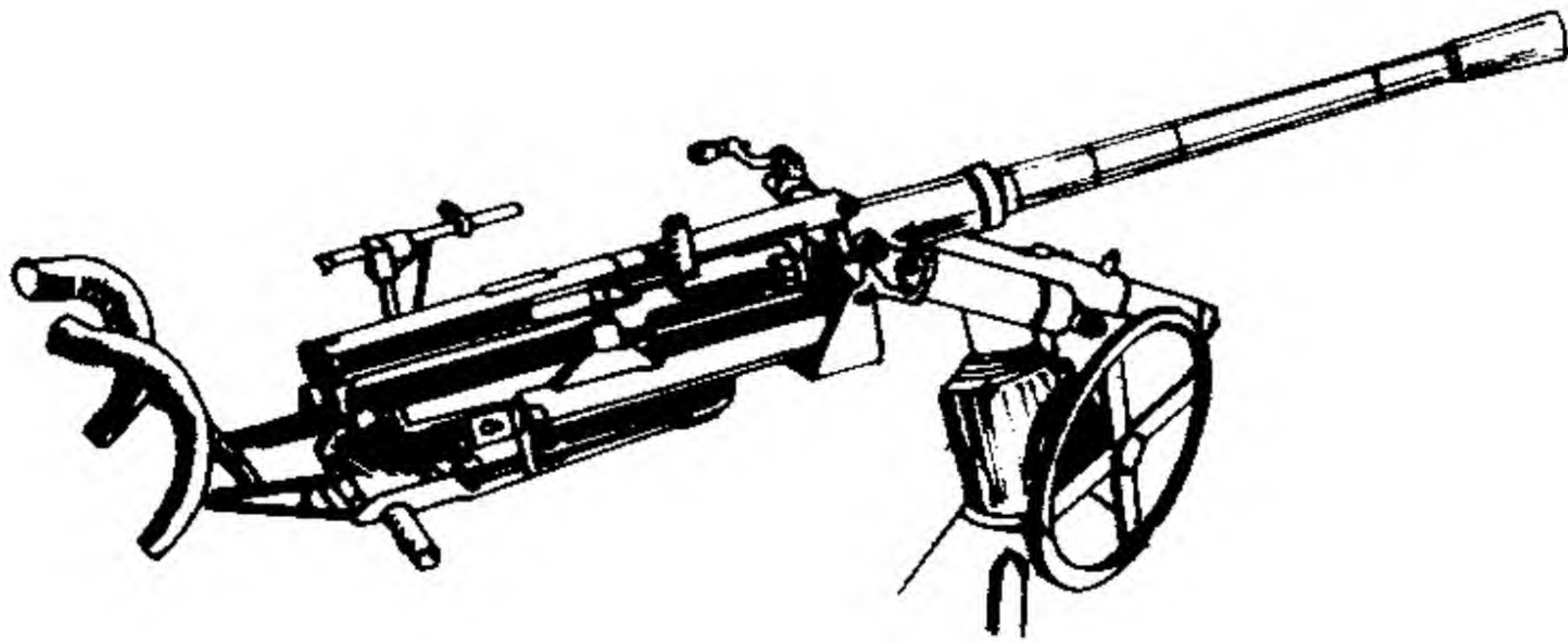
E2/1



E2/2



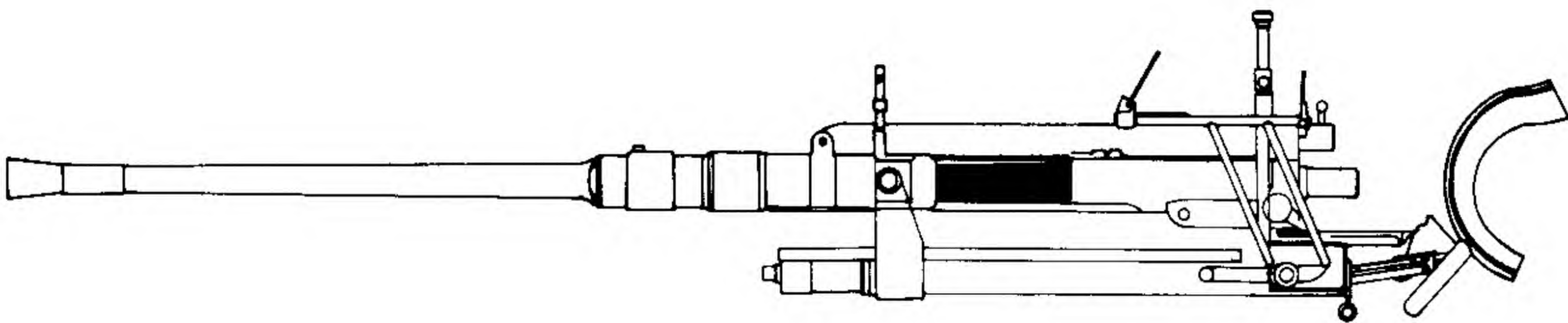
E2/3



E Armament and fittings

E3 2cm FlaK 38 (1/25 scale)
This weapon was a refinement of the MG C30, but was initially on the same mounting as that weapon.

E3



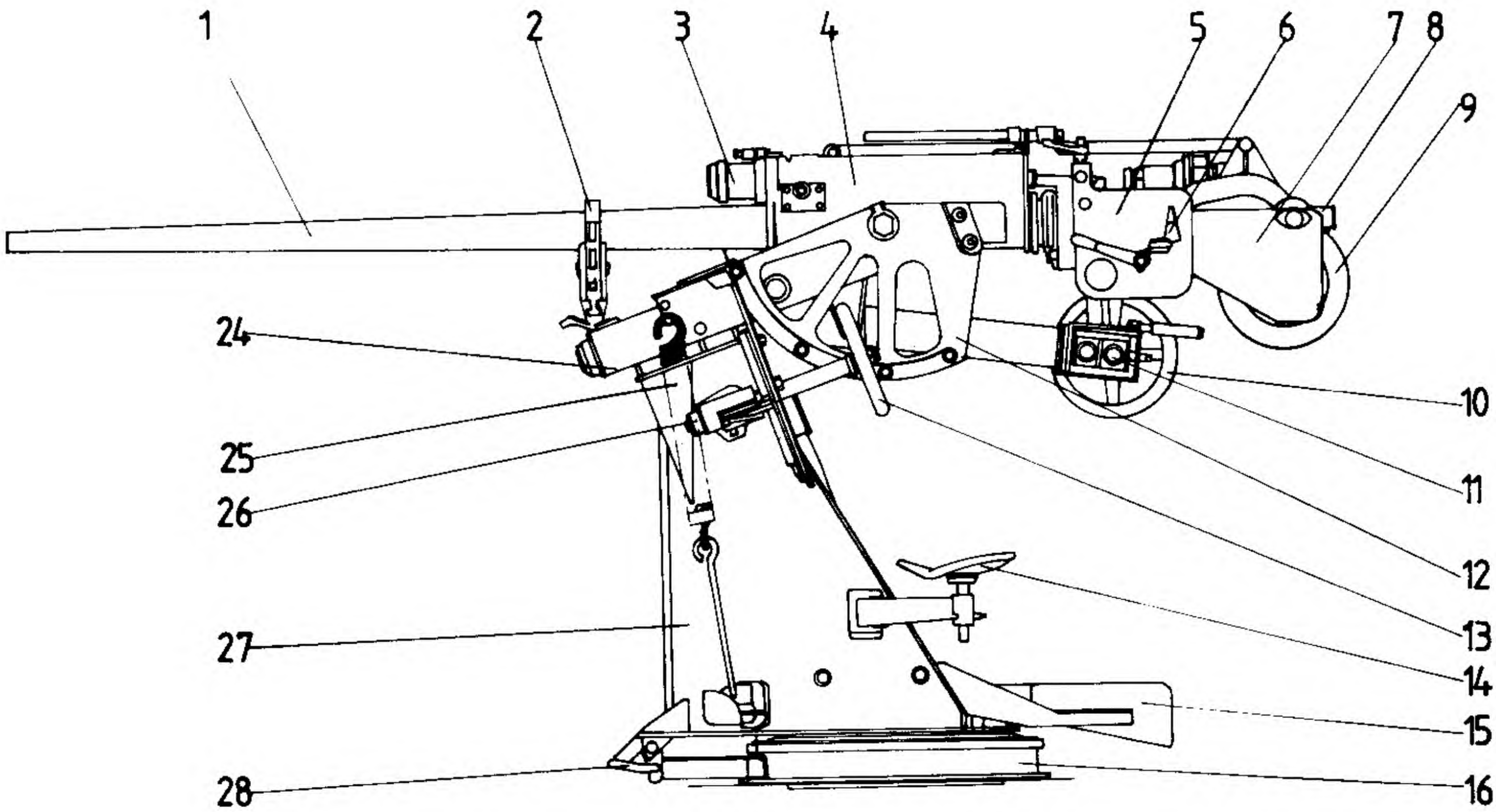
**E4 3.7cm SKC30U ON LC 39
MANUAL LOADING MOUNTING
(1/50 scale)**

E4/1

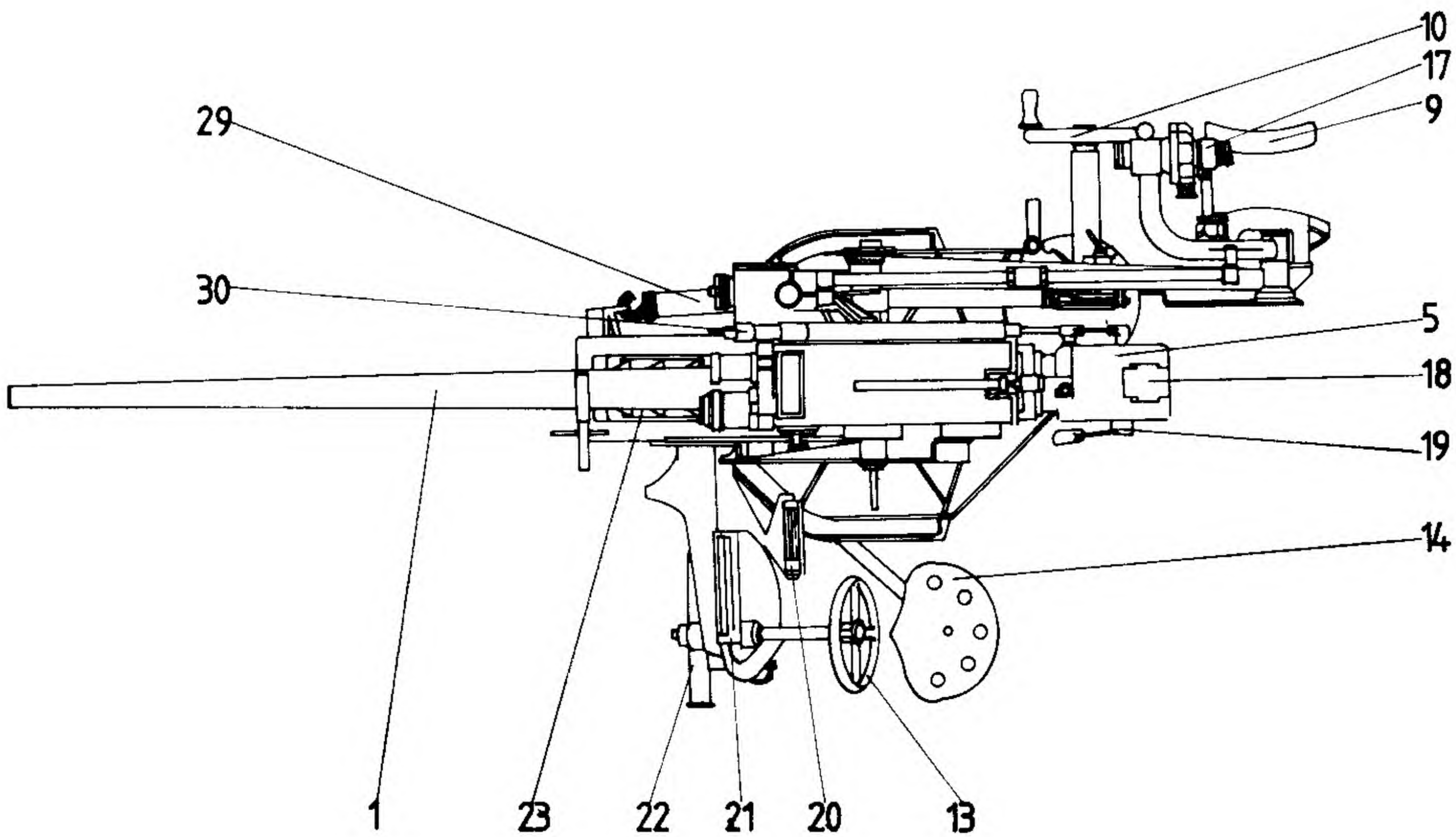
E4/1 Elevation

E4/2 Plan

- 1 Gun barrel
- 2 Travelling lock
- 3 Recuperator cylinder
- 4 Gun body
- 5 Breech housing
- 6 Ready-to-fire indicator
- 7 Shield for elevation number
- 8 Elevation number shoulder piece
- 9 mounting bar
- 10 Left shoulder piece for elevation number
- 11 Elevation control wheel
- 12 Fuse setter
- 13 Gun cradle
- 14 Traverse control handle
- 15 Traverse number seat
- 16 Pedestal
- 17 Gun mounting base
- 18 Elevation optical sight
- 19 Breech block
- 20 Breech operating lever
- 21 Traverse sight
- 22 Lead indicator
- 23 Mounting bar and transmission shaft for traverse controls
- 24 Barrel slide
- 25 Stabilising buffer
- 26 Mounting piston
- 27 Traverse gearing
- 28 Gun mount
- 29 Traverse lock
- 30 Mounting piston
- 31 Breech automatic opening linkage (on recoil)



E4/2



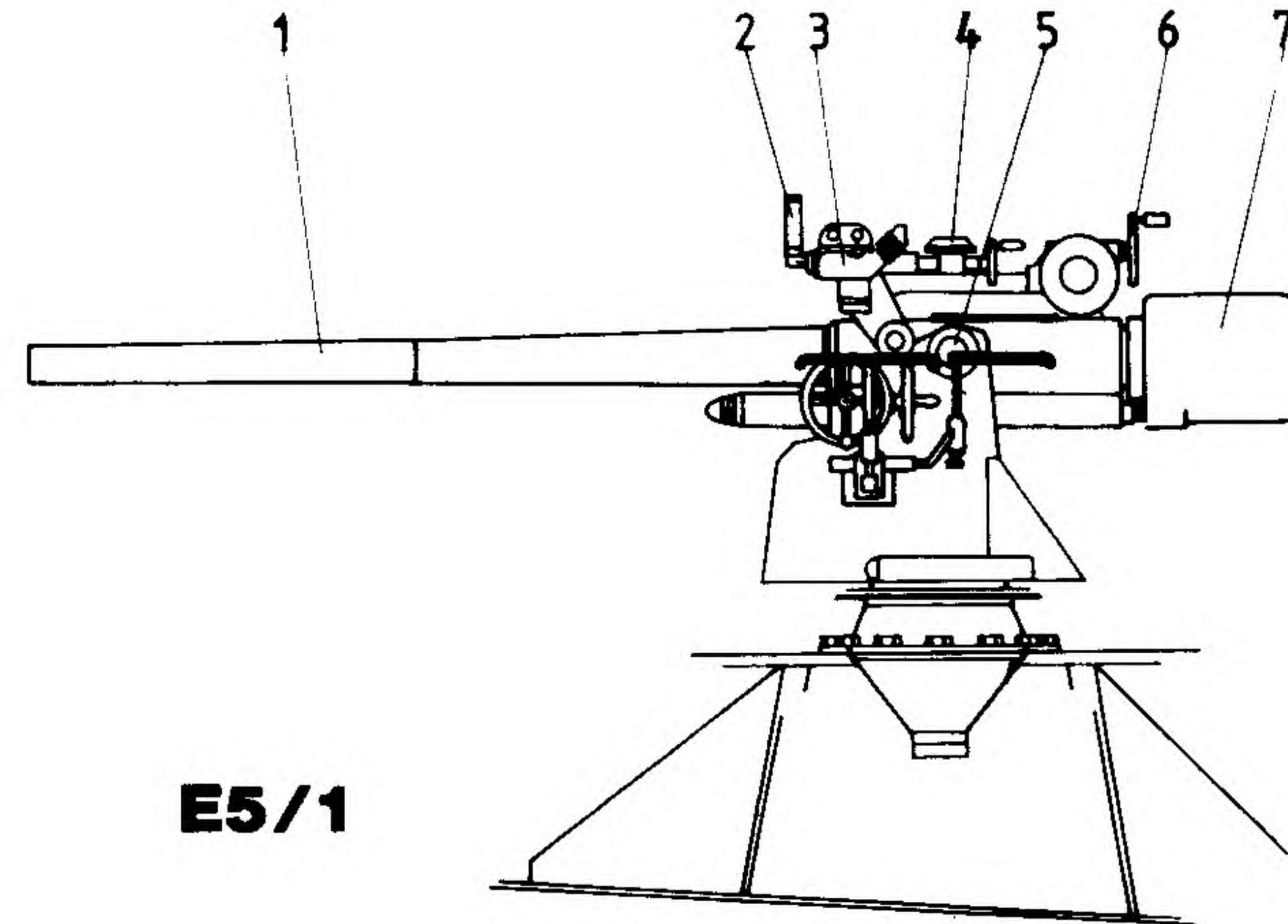
E5 8.8cm SKC35 ON LC 35 MOUNTING

E5/1 Elevation (1/50 scale)

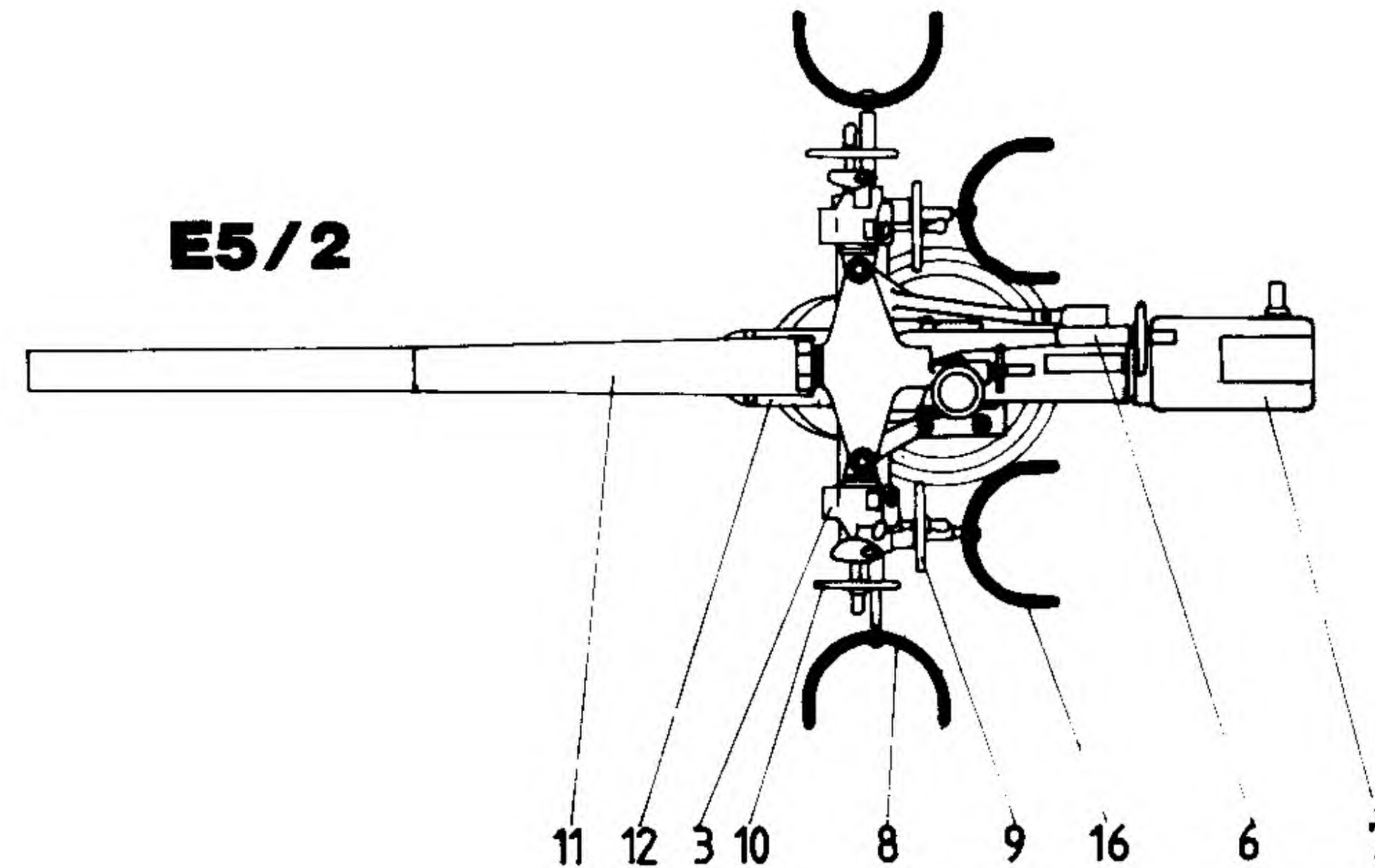
E5/2 Plan view (1/50 scale)

E5/3 Front view (1/50 scale)

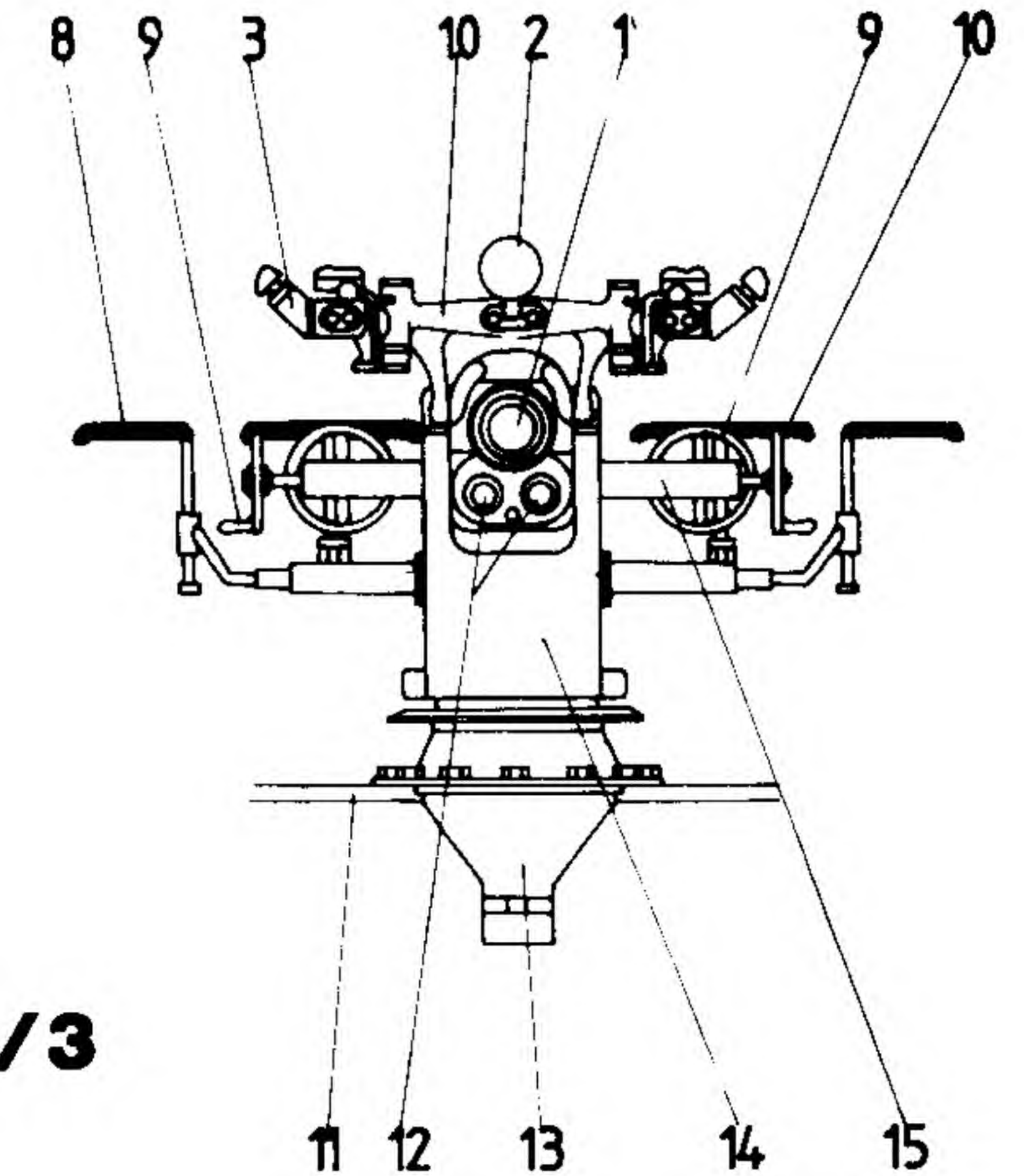
- 1 Gun barrel
- 2 Lead sight
- 3 Combined elevation and traverse sight (could be mounted either to left or right of gun). Two gunners operated this sight and the firing controls
- 4 Deflection setting dial for lead sight
- 5 Pintle
- 6 Deflection setting handle for lead sight
- 7 Breech housing
- 8 Elevator's safety harness
- 9 Traversing control wheel
- 10 Elevation control wheel
- 11 Rear barrel section
- 12 Recoil tray
- 13 Mounting counterweight
- 14 Main mounting body
- 15 Controls and gearing arm
- 16 Traverse number's safety harness



E5/1

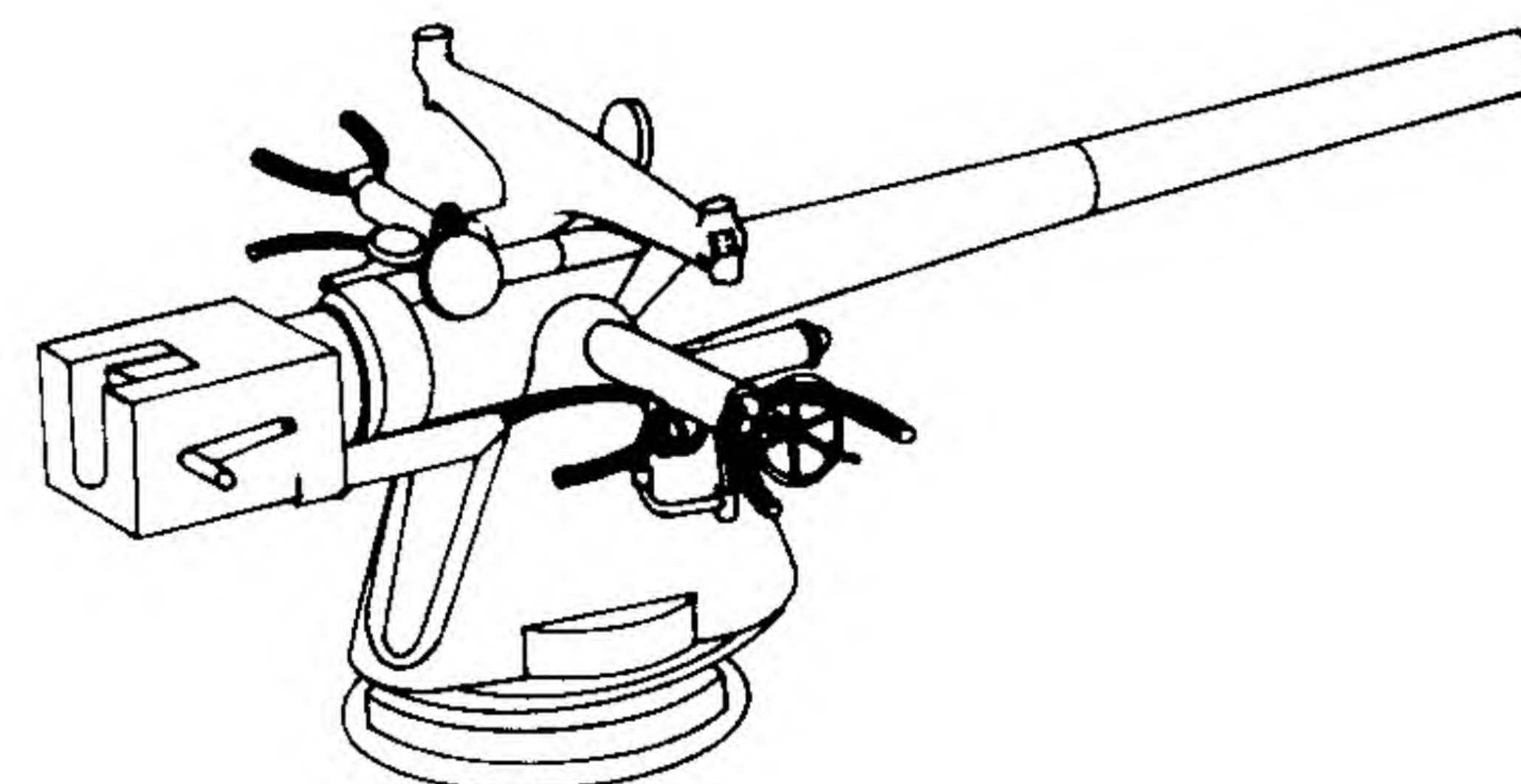


E5/2



E5/3

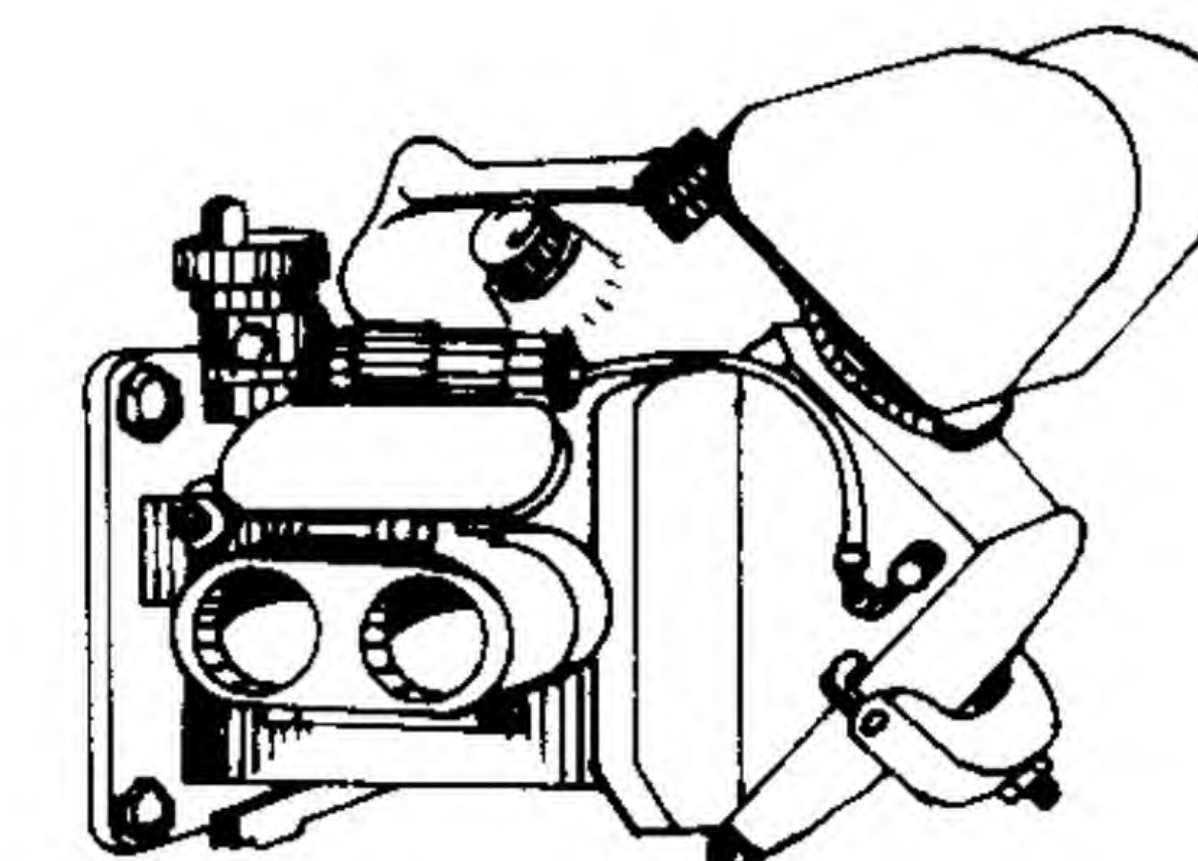
E5/4



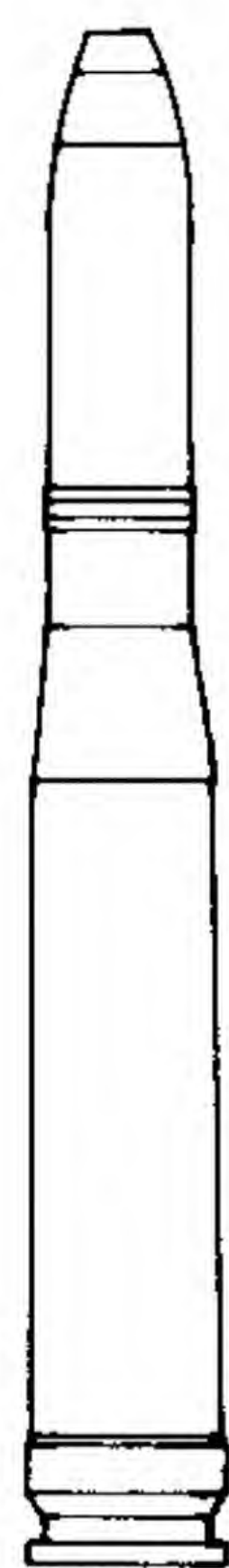
E5/4 General view (no scale)

E5/5 Gunsight detail (no scale)

E5/5



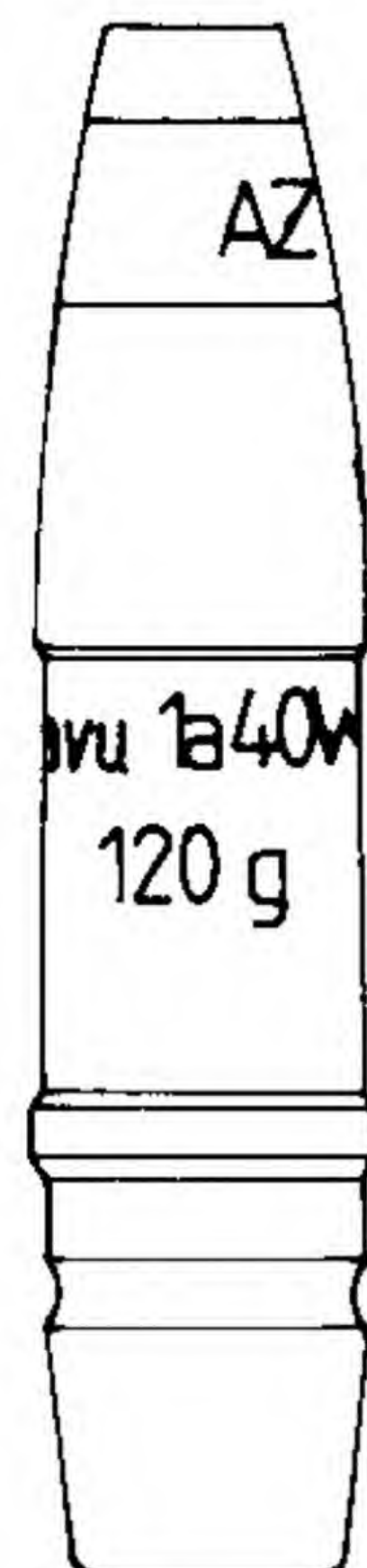
E Armament and fittings



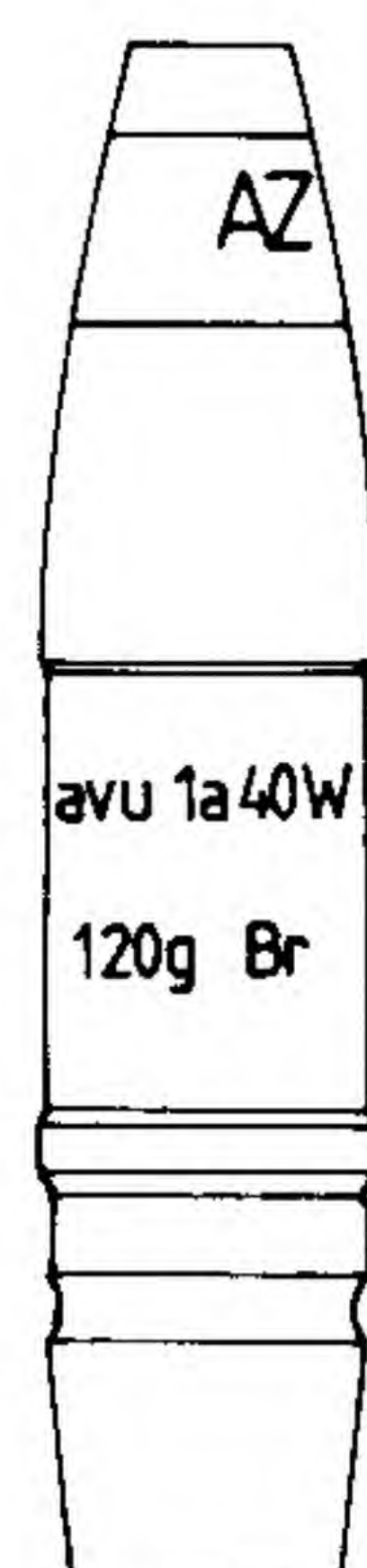
E6/1



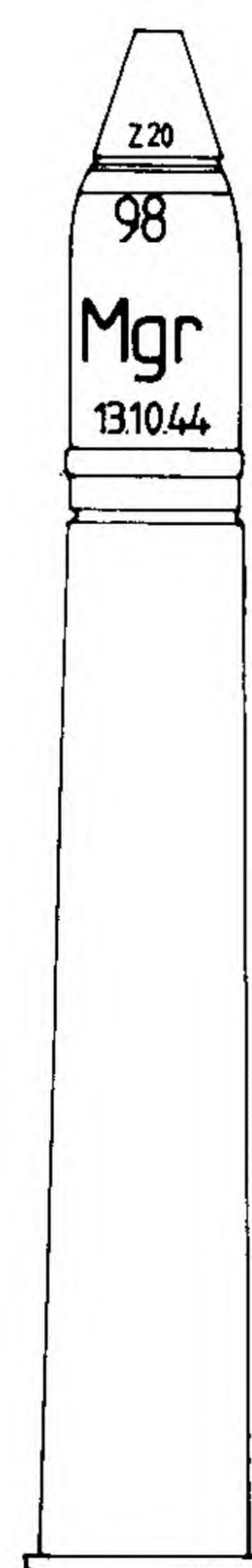
E6/2



E6/3



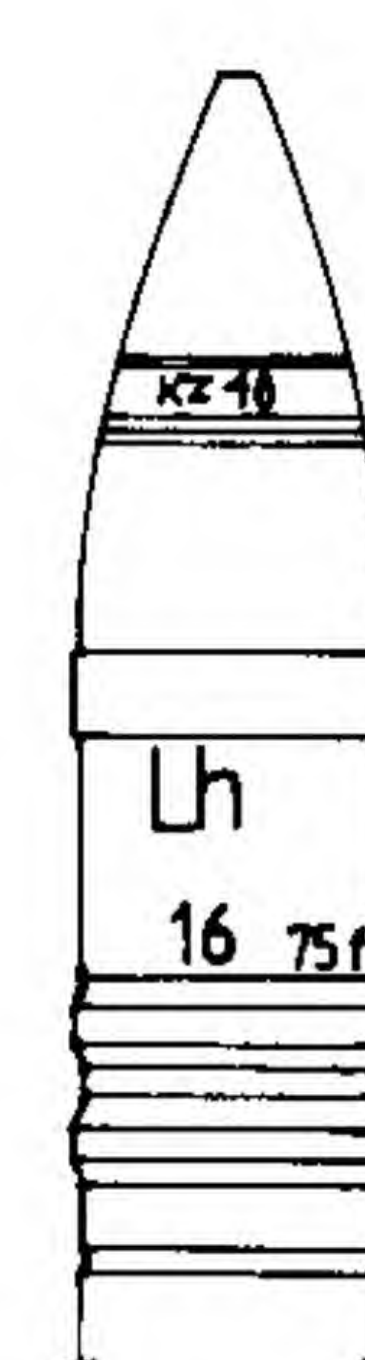
E6/4



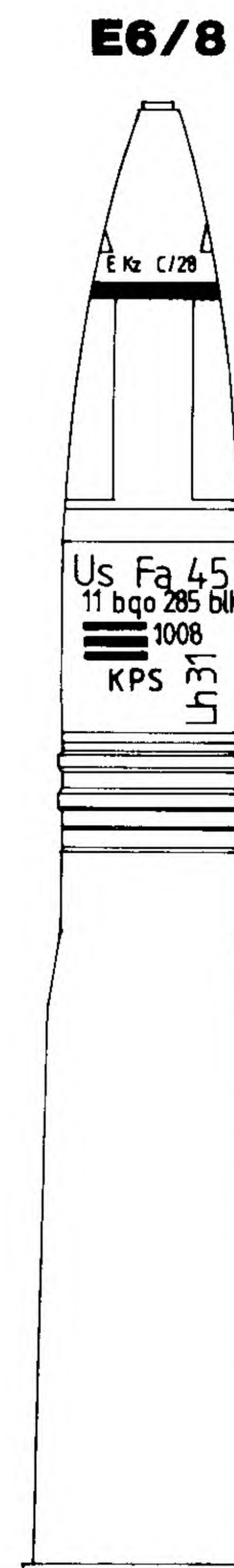
E6/5



E6/6



E6/7



E6/8

E6 SHELLS (not to a common scale)

E6/1 2cm cartridge

E6/2 2cm HE Tracer

E6/3 2cm HE Tracer (red)

E6/4 2cm HE/Incendiary Tracer

E6/5 3.7cm HE cartridge

E6/6 3.7cm HE/Tracer shell (cartridge truncated)

E6/7 3.7cm HE/Incendiary/Tracer (cartridge truncated)

E6/8 8.8cm C35 L/4.5 HE/Tracer cartridge

E6/9 Base markings on above shell

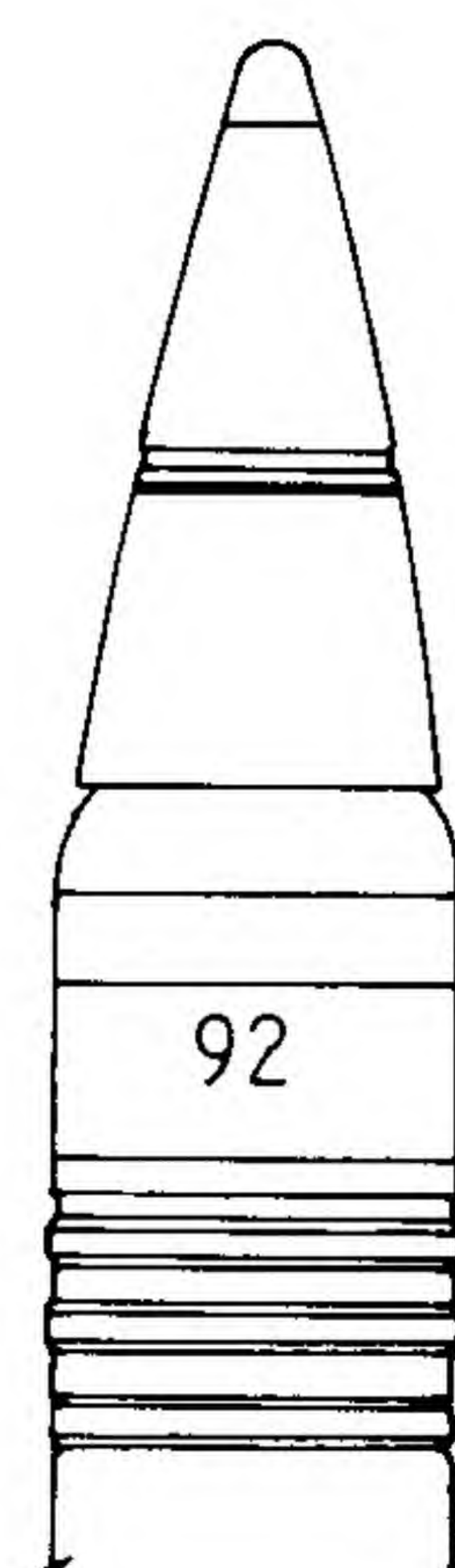
E6/10 8.8cm APCBC shell (case truncated)

E6/11 8.8cm Star Shell with fuse S/33

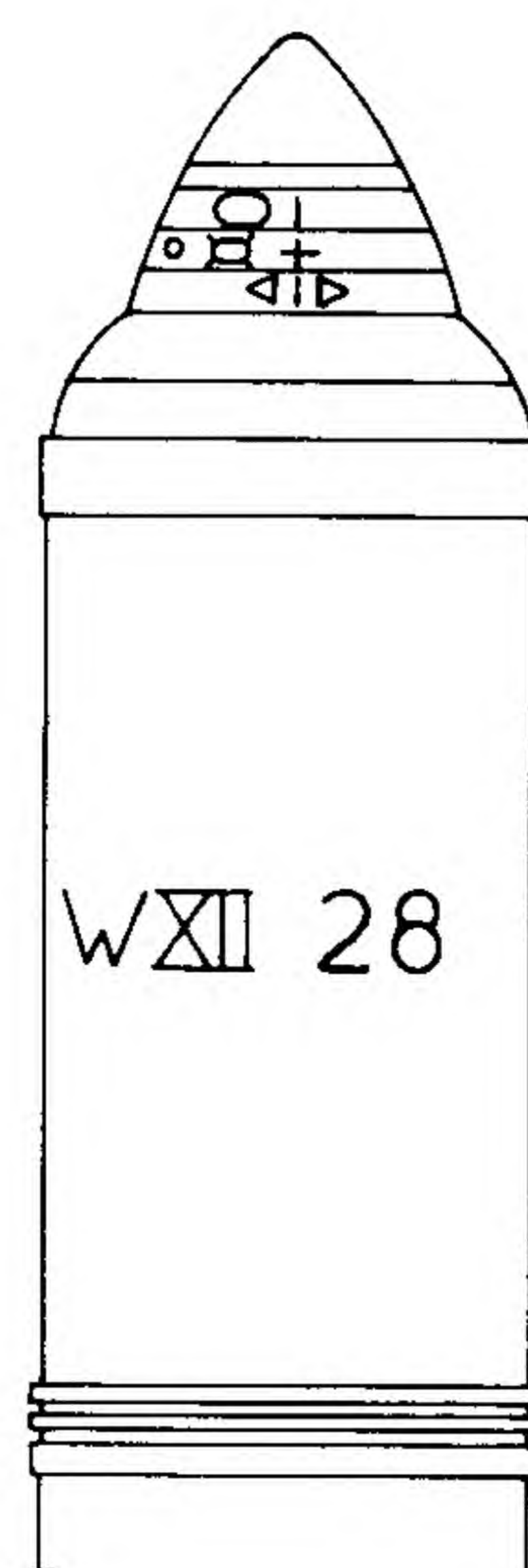
E6/12 Brass time fuse S/33 for above

E6/13 8.8cm FlaK Star Shell with S/60 time fuse (not shown)

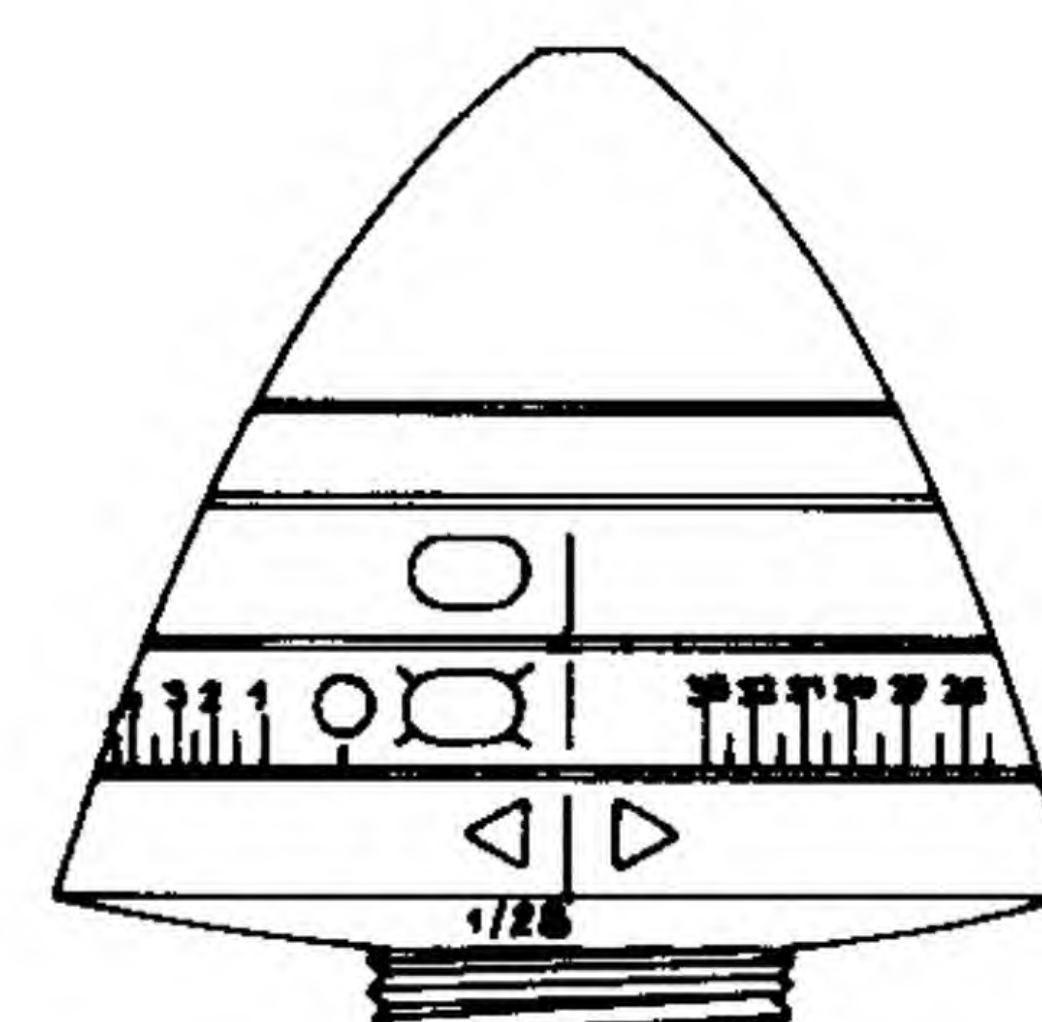
E6/10



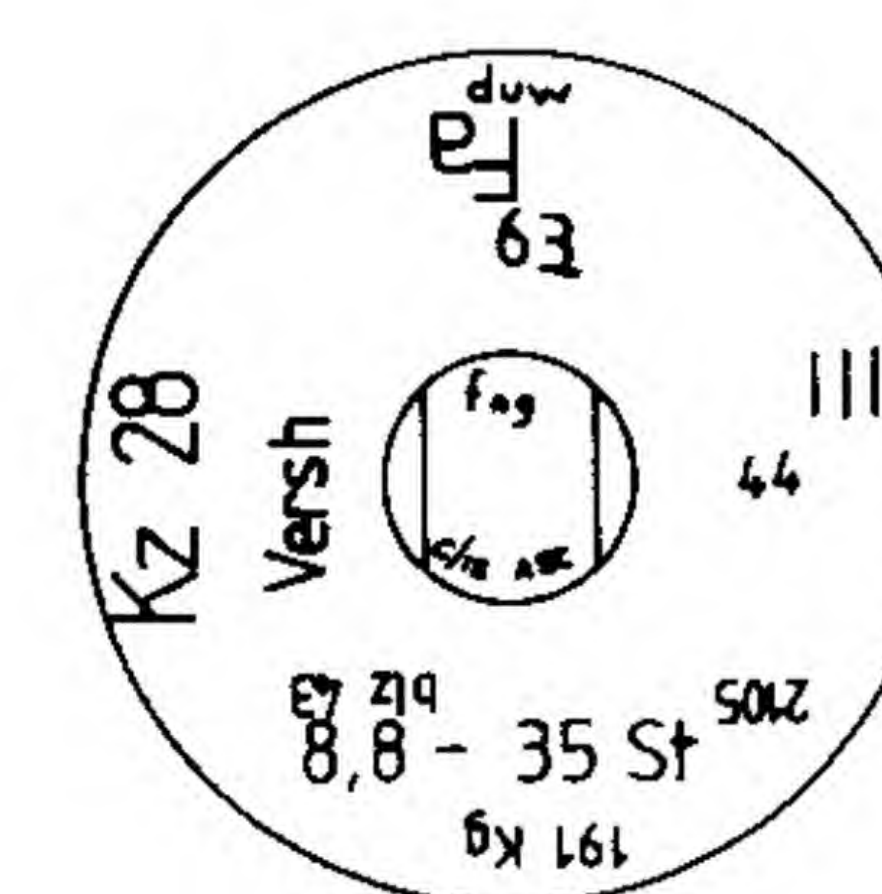
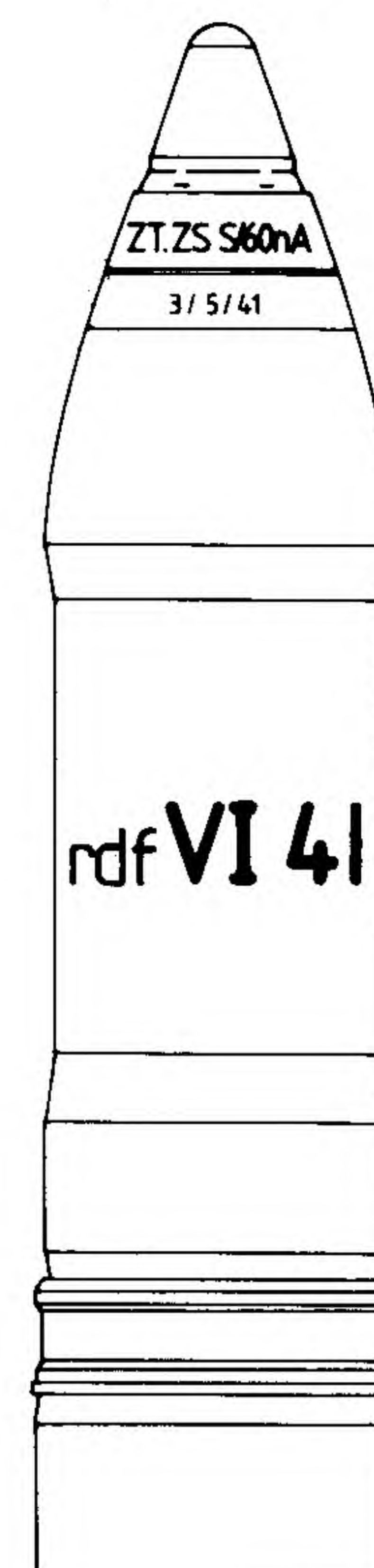
E6/11



E6/12



E6/13

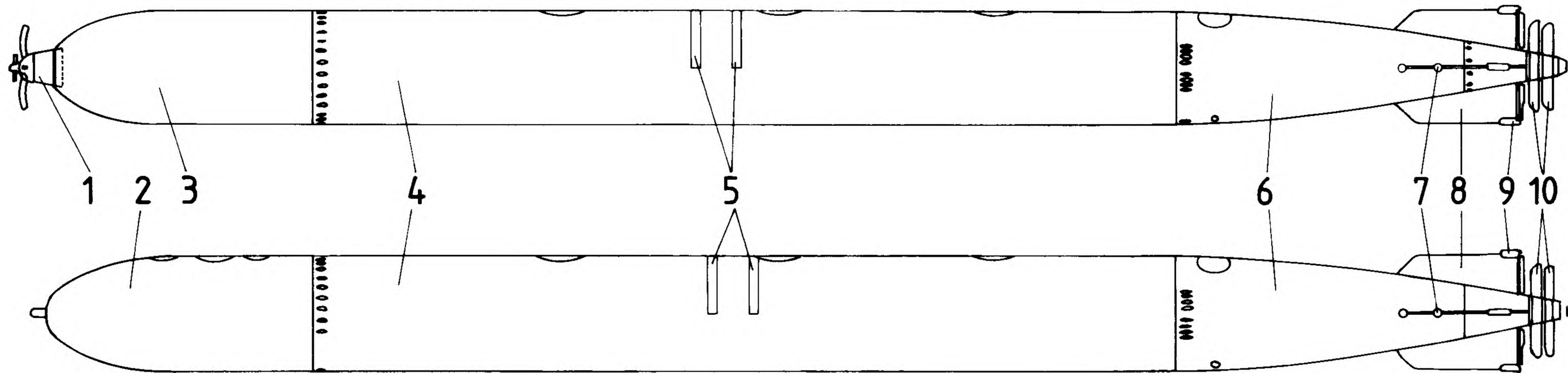


E6/9

E7 TORPEDOES

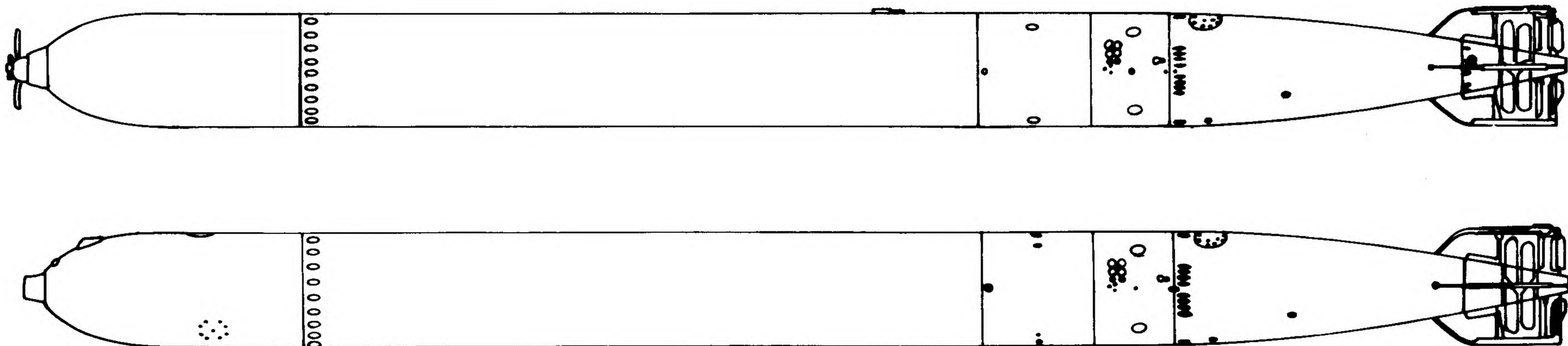
E7/1 53.3cm G7e TORPEDO (1/30 scale)

- | | | | |
|---|--|----|--|
| 1 | Firing pistol (here the G7H is shown) | 6 | Rear body and electric motor housing |
| 2 | Practice warhead | 7 | Depth keeping fins (both sides) |
| 3 | Warhead | 8 | Attitude fins |
| 4 | Main body and battery container | 9 | Attitude adjusters (controlled by internal gyro-compass) |
| 5 | Green torpedo-type markings (positions varied) | 10 | Contra-rotating propellers |



E7/1

E7/2 G7a TORPEDOES (1/30 scale)
This is the first service torpedo used by the U-boat Arm in the Second World War and was propelled by compressed air. The emission of a stream of bubbles from the outlet at the tail made the torpedo too obvious in daylight, and it was soon superseded by the G7e. The lower view shows the practice head.



E7/2

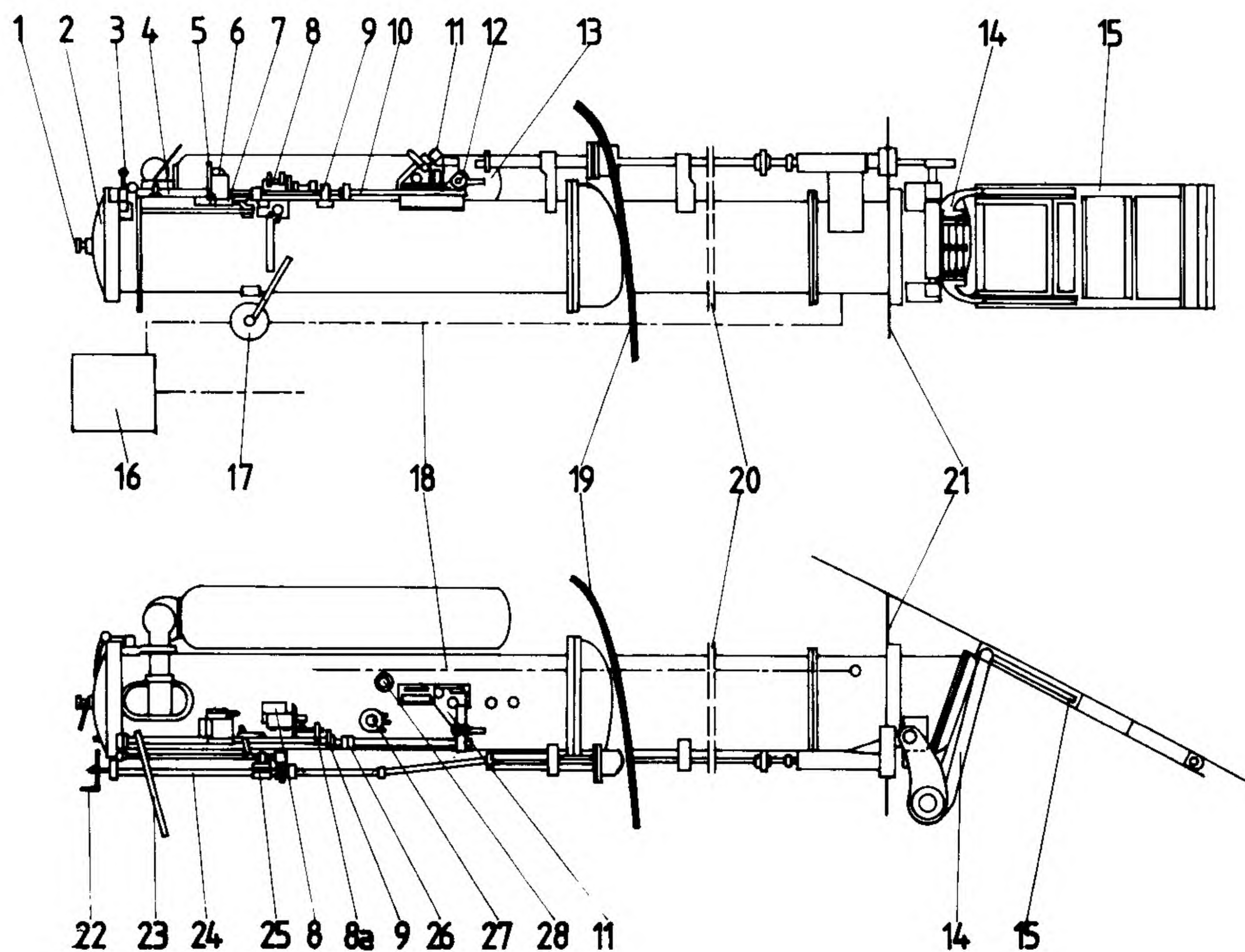
E Armament and fittings

E8 TORPEDO TUBE II (PORT SIDE, UPPER)

E8/1 Starboard elevation (no scale)

E8/2 Plan view (no scale)

- 1 Tube cap handle
- 2 Tube cap
- 3 Manual firing lever
- 4 Firing arm
- 5 Firing pin
- 6 Electromagnetic firing coil
- 7 Cocking arm
- 8 Air ventilator
- 9 Arm support
- 10 Gyro setting arm
- 11 Torpedo inspection port dock
- 12 Torpedo inspection port release catch
- 13 High pressure air bottle (for venting tube on reloading)
- 14 Bow door hinge
- 15 Bow door
- 16 Compensating tank (schematic)
- 17 Inlet/outlet valve for tube
- 18 Water line (schematic)
- 19 Bow cap of pressure hull
- 20 Bow casing tube support bulkhead
- 21 Tube stabilising plate
- 22 Manual control for bow door
- 23 Safety plate
- 24 Bow door control linkage
- 25 Bow door/firing mechanism safety
- 26 Gyro setting arm fine adjustment screw
- 27 Gyro manual adjustment
- 28 Depth setting dial

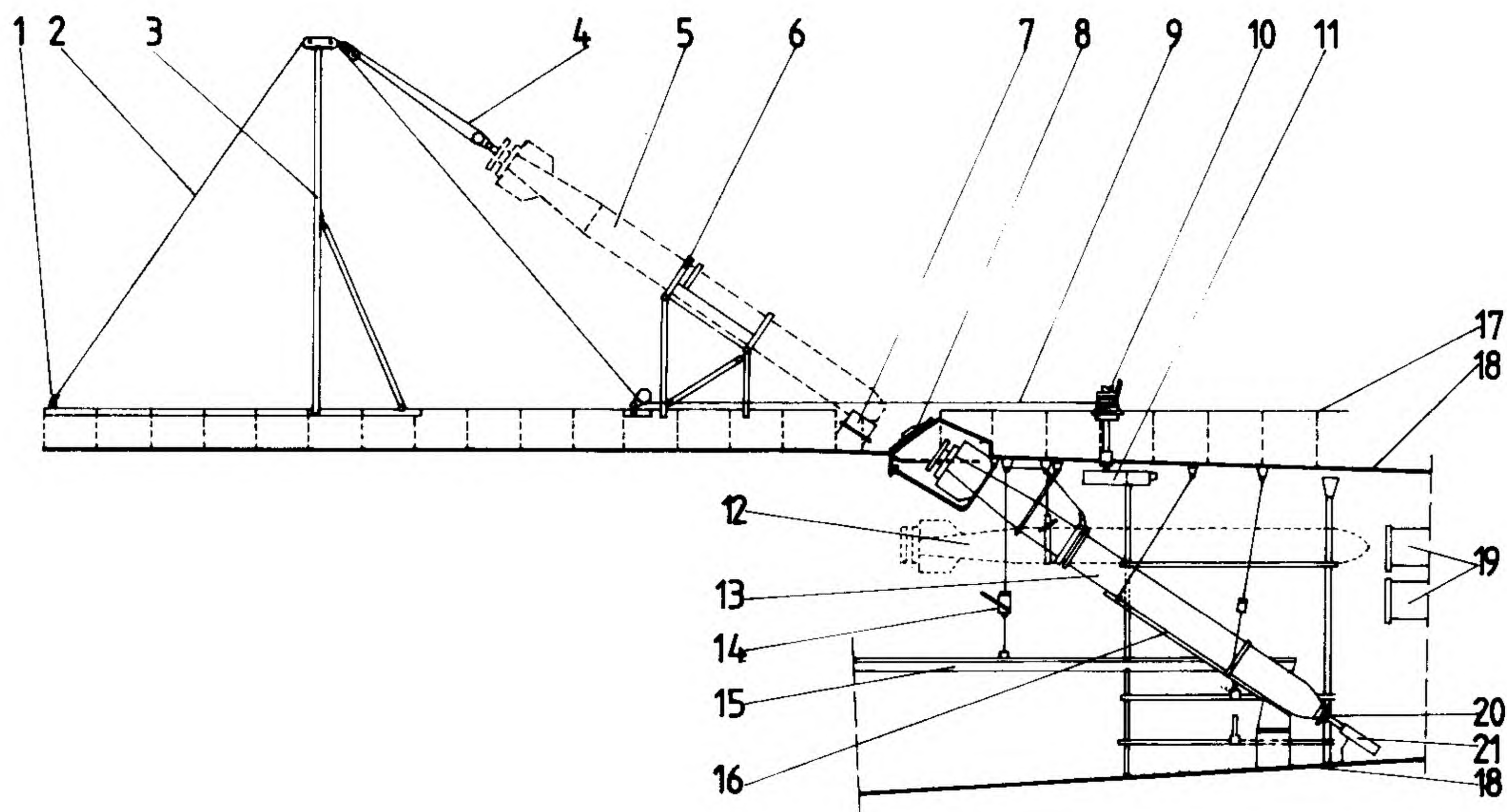


E8/1

E8/2

E9 TORPEDO LOADING GEAR (no scale)

- 1 Rear hitch
- 2 Tensioning wire
- 3 Sheerleg post
- 4 Torpedo safety wire
- 5 Torpedo being loaded
- 6 Torpedo cradle
- 7 Nose guide
- 8 Forward torpedo loading hatch door
- 9 Loading wire
- 10 Winch head
- 11 Winch gearbox
- 12 Torpedo in loading position for reload
- 13 Torpedo in second loading position before stowing
- 14 Hand ratchet
- 15 Stowage platform
- 16 Carrying cradle
- 17 Outer casing
- 18 Pressure hull
- 19 Torpedo tubes
- 20 Torpedo nose cup
- 21 Buffer

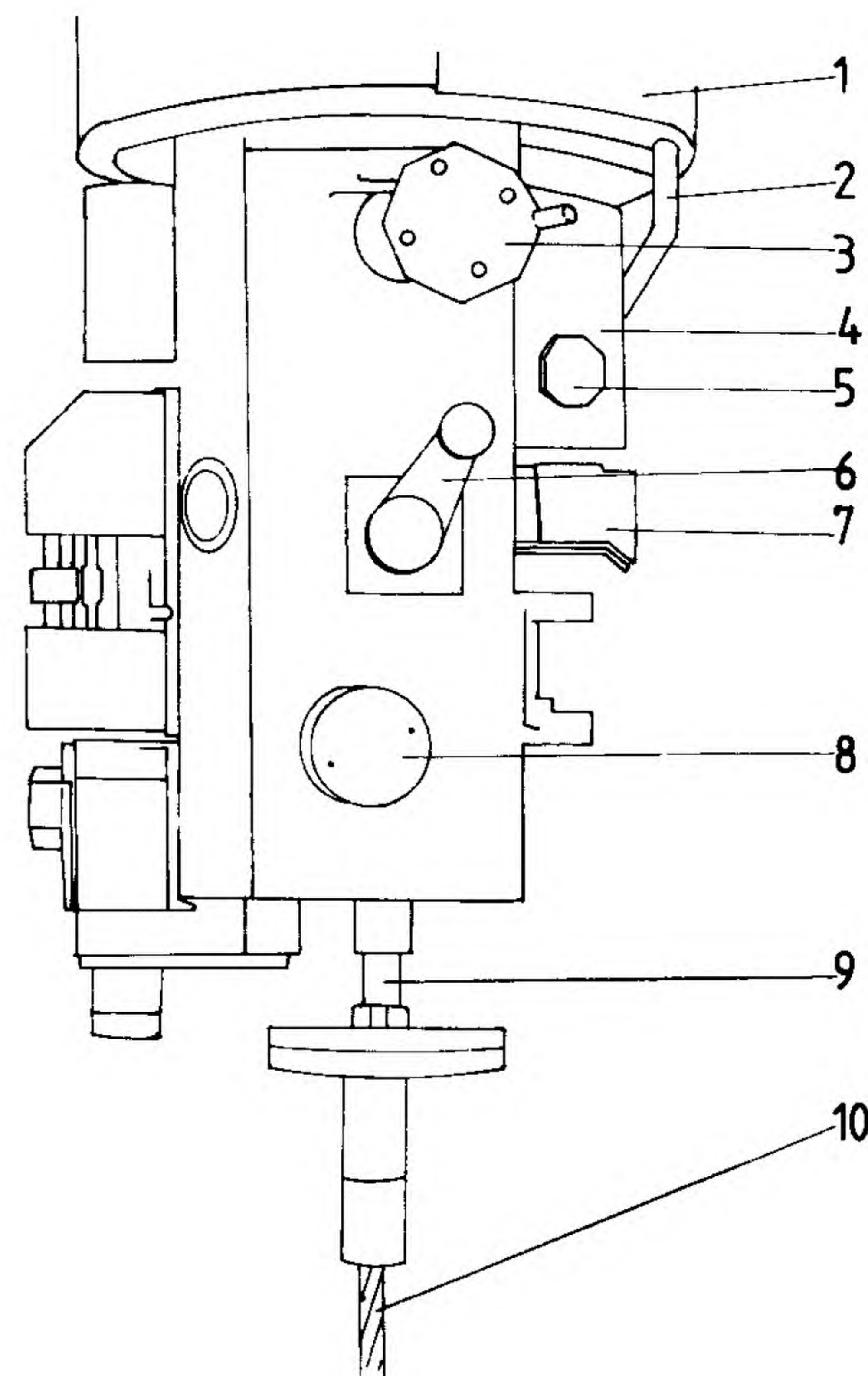


E9

E10 BRIDGE FITTINGS (no scale)

E10/1 CONTROL ROOM PERISCOPE

- 1 Periscope pressure hull housing
- 2 Water bleeder
- 3 Head angle setting wheel (-15° to $+50^{\circ}$)
- 4 Illumination control box
- 5 Illumination control wheel
- 6 Magnification control arm
- 7 Eyepiece
- 8 Arm/hand rest and rotation control
- 9 Base link
- 10 Retraction cable



E10/1

E10/2 EARLY TYPE SCHNORCHEL

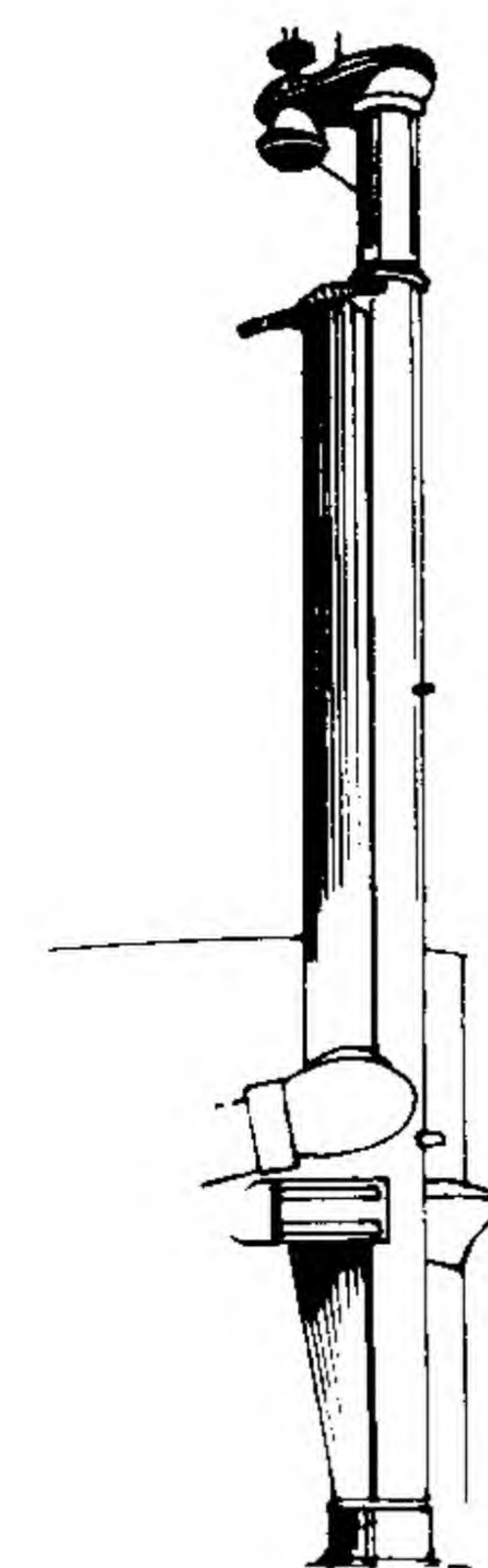
E10/3 LATER TYPE SCHNORCHEL HEAD

E10/4 FuMB 7, 'NAXOS' AERIAL

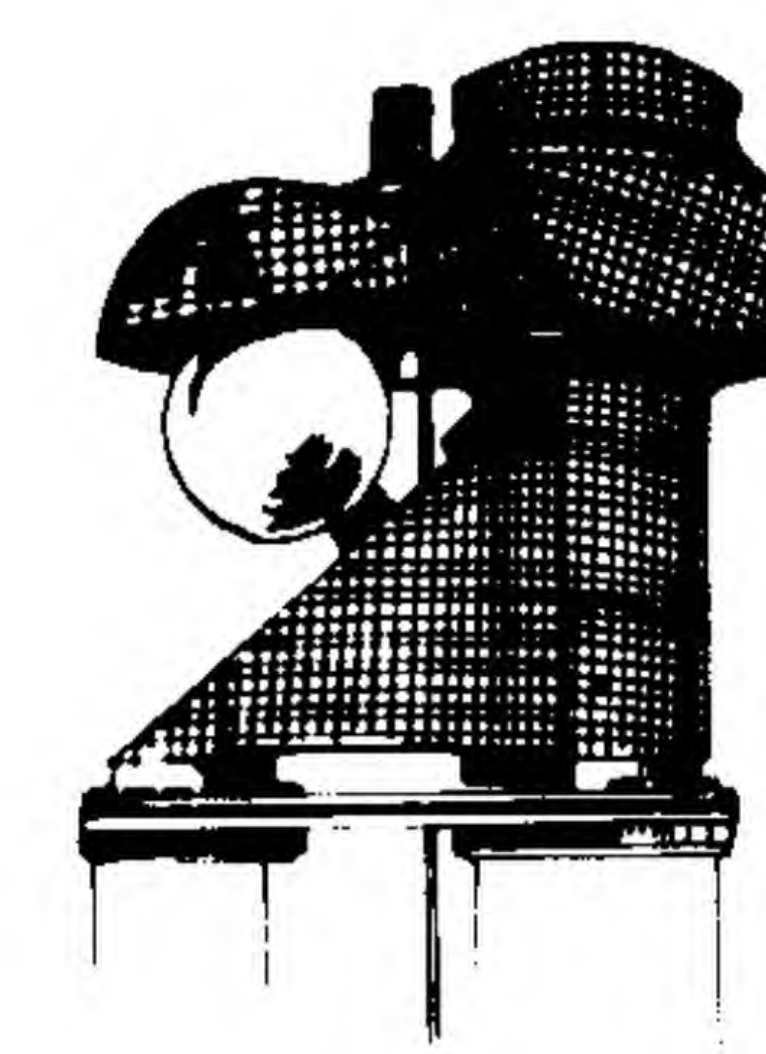
E10/5 FuMB AERIAL 2, 'METOX' ('BISCAY CROSS')

E10/6 UZO (Unterseeboots Ziel Ortungsgerät - submarine target binoculars and transmitter; no scale)

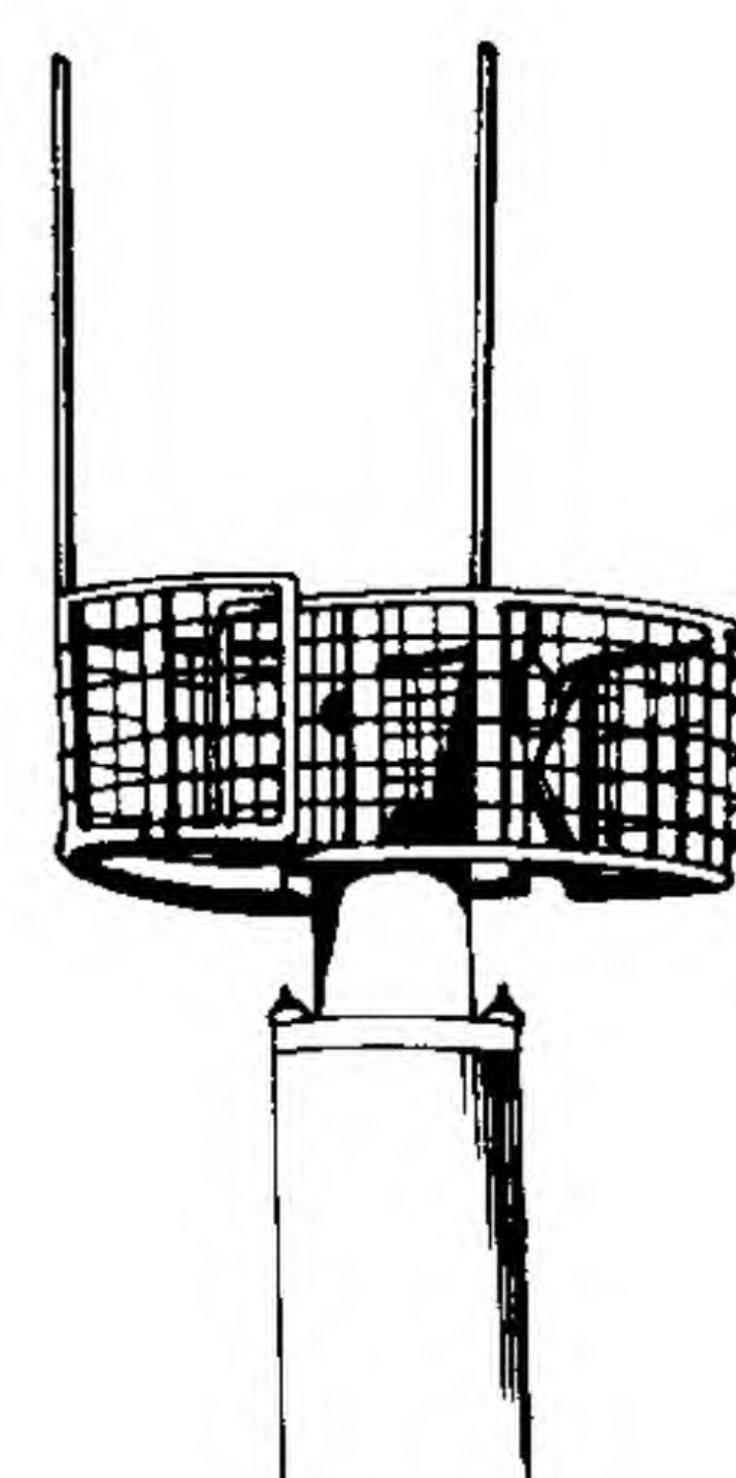
- 1 Rough alignment sight
- 2 Binoculars
- 3 UZO transmitting head (giving bearing to target and lay-off angle)
- 4 Traversing arm
- 5 Locking nut
- 6 Angular scale (0° was head of the boat)



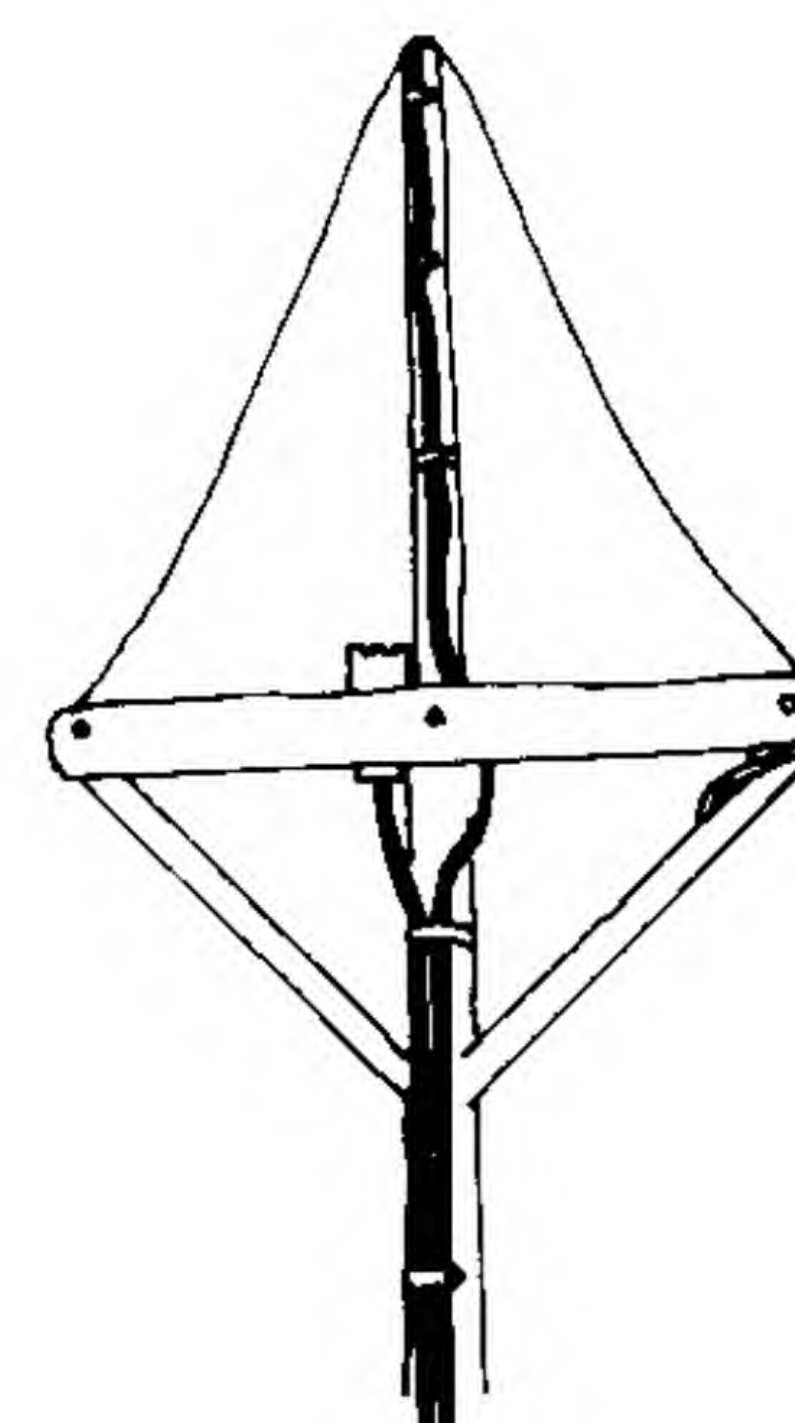
E10/2



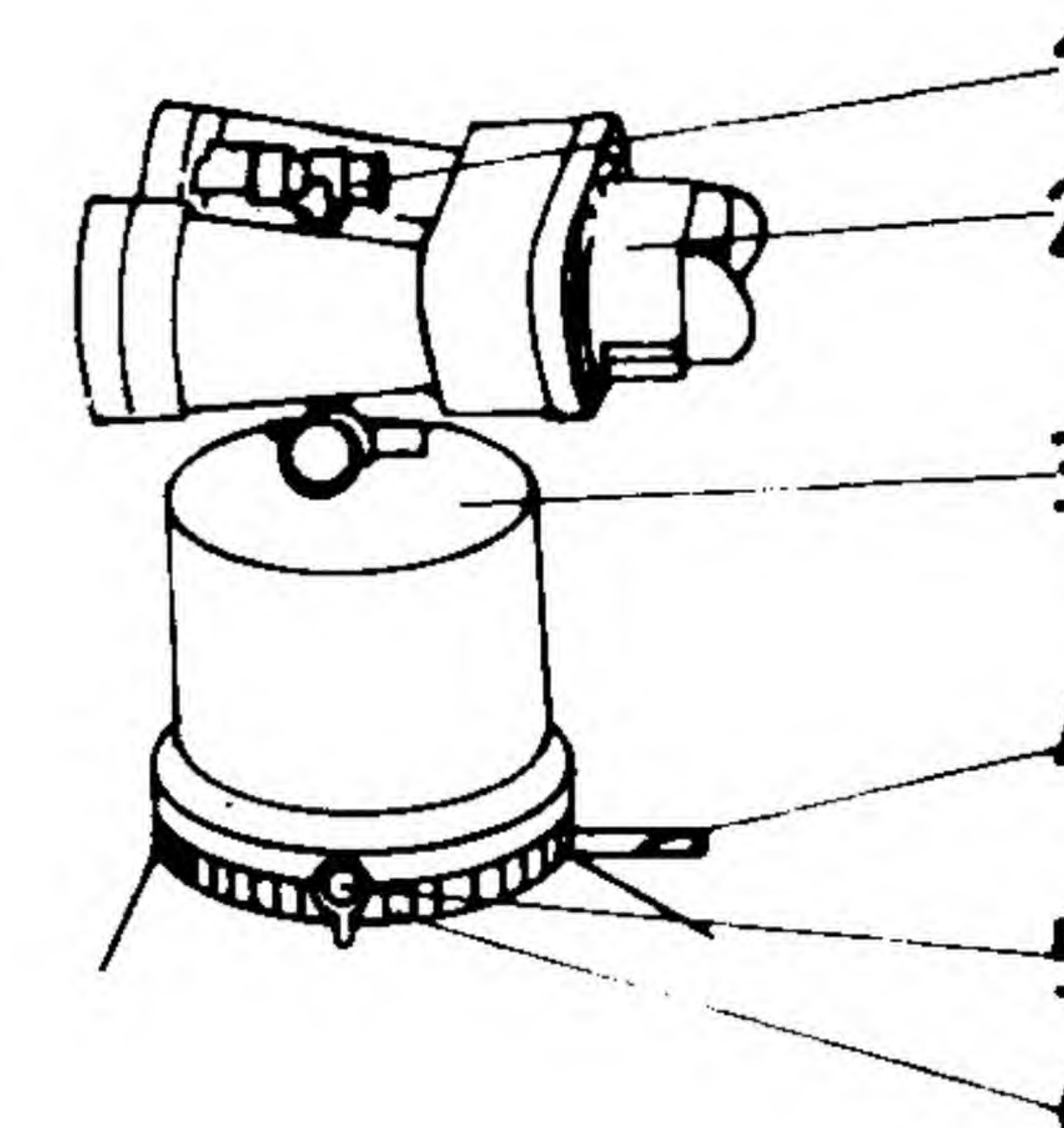
E10/3



E10/4



E10/5



E10/6

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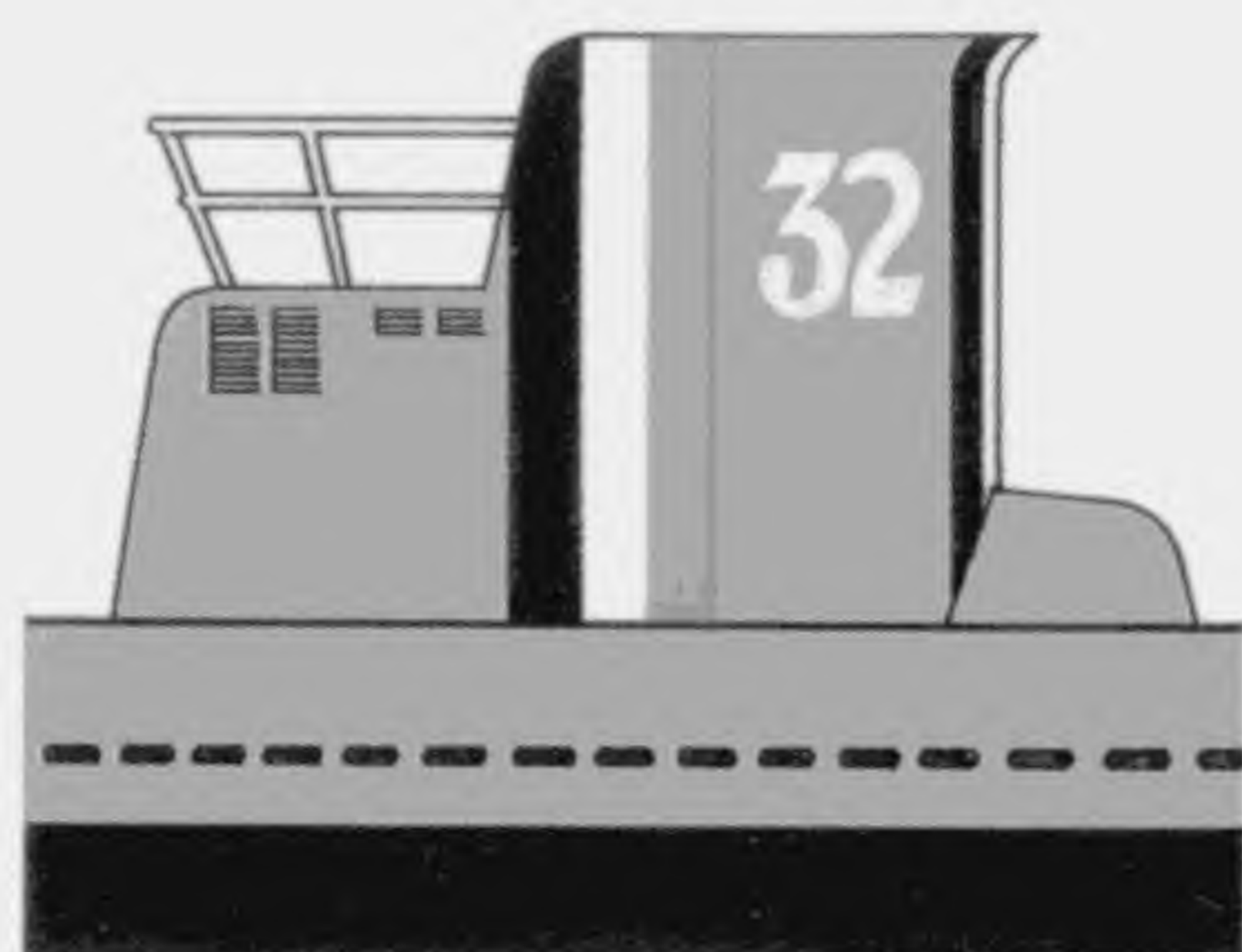
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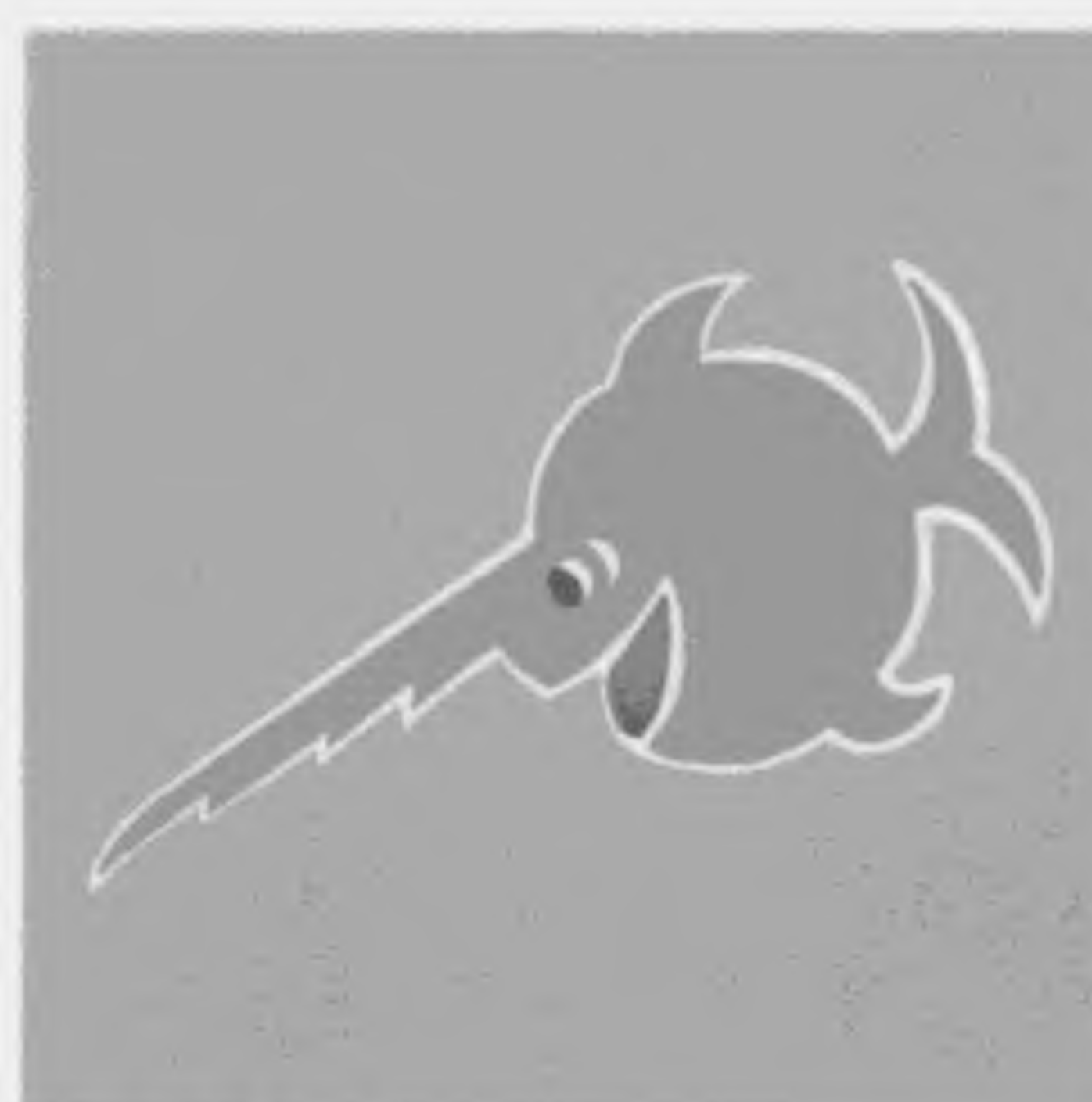
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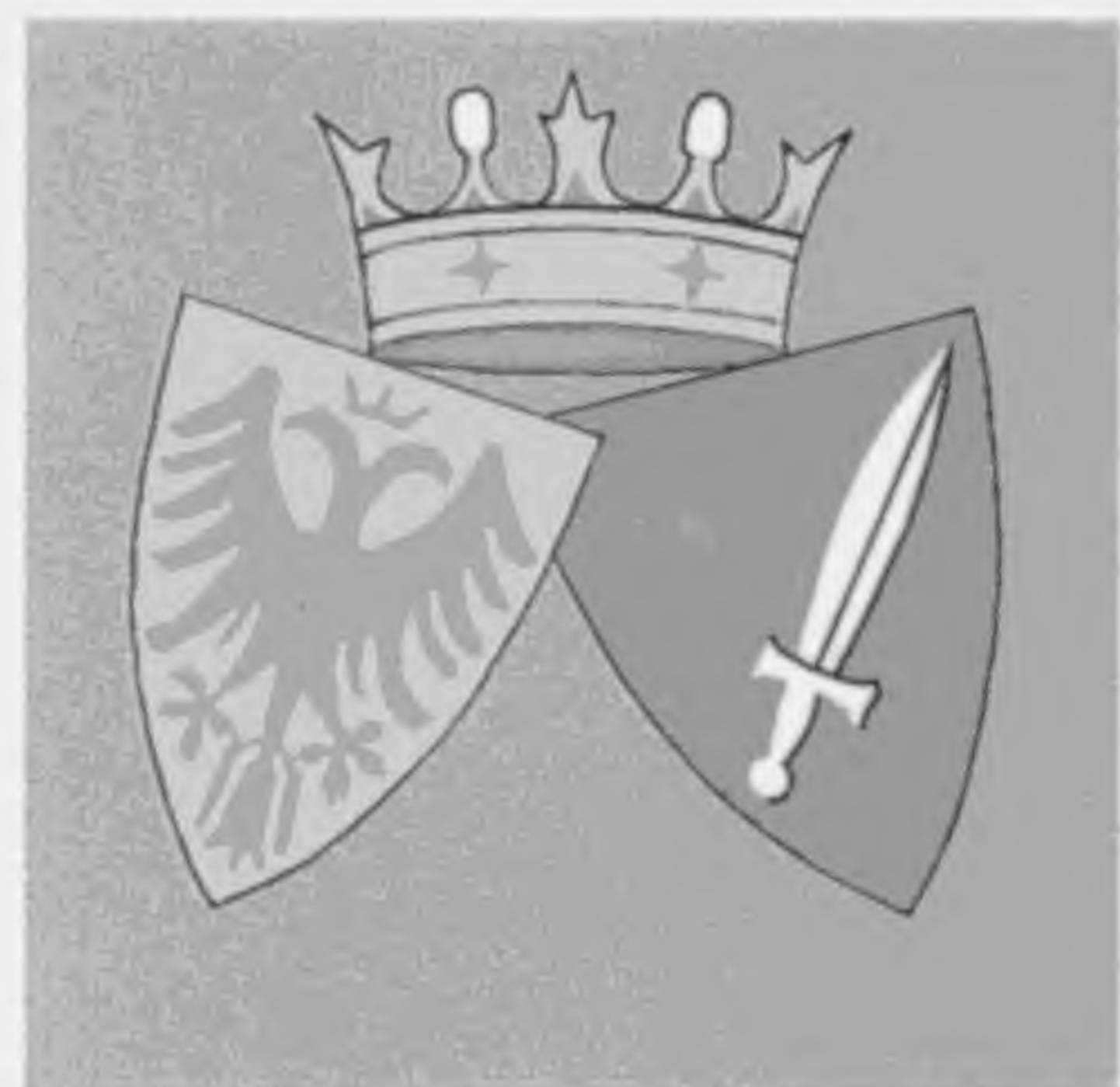
U 99



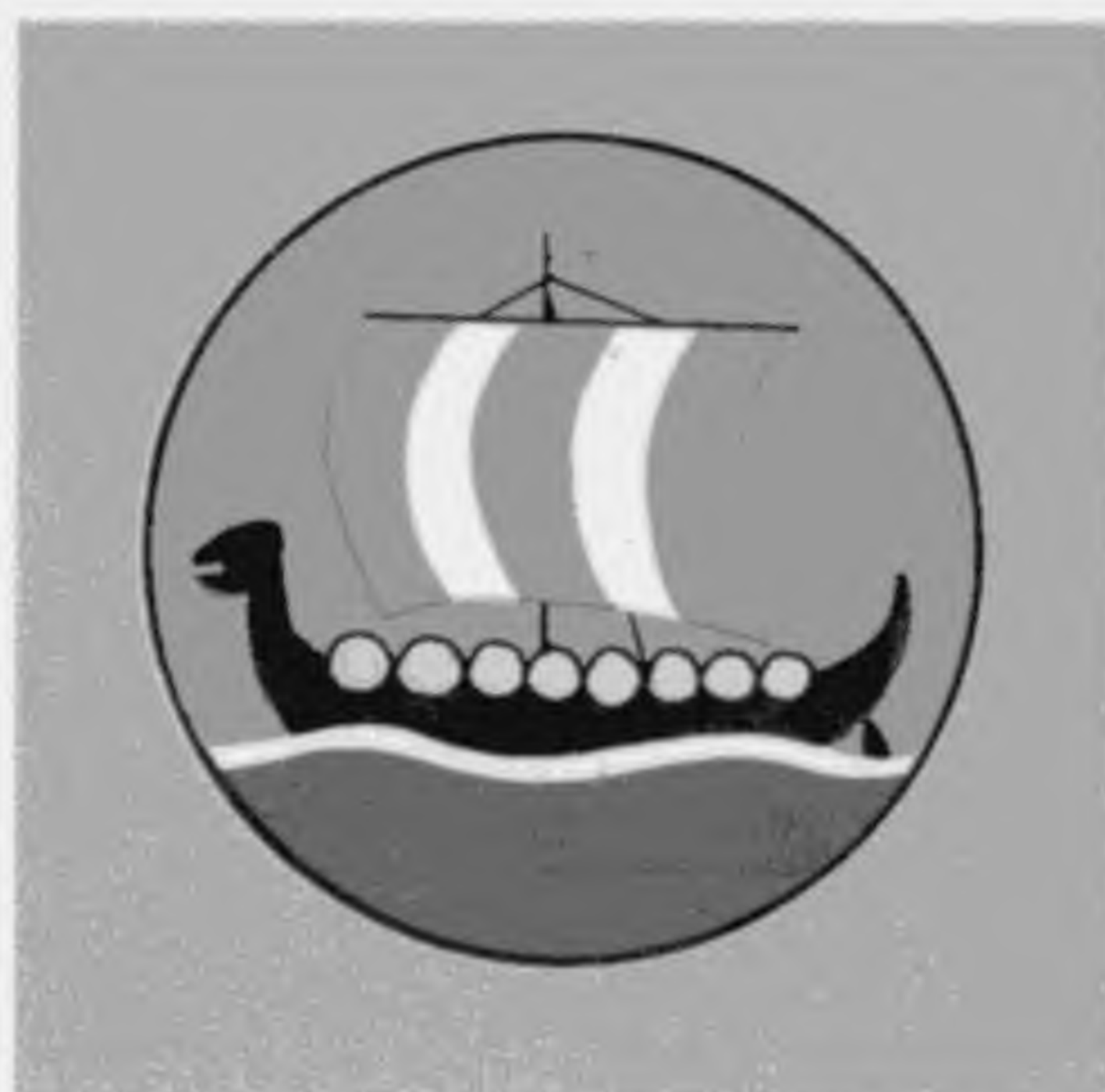
9th Flotilla



7th Flotilla



U 203, 1942
(Arms of the City of Essen)



U 83, La Spezia February 1942



U 753, June 1942



U 132, 1942